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BULLETIN

DE LA

SOCIÉTÉ ROYALE ENTOMOLOGIQUE

D'ÉGYPTE

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FONDEE LE 1er AOUT 1907

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Fatti non foste a viver come bruti,
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DANTE

Placée sous le Haut Patronage du Gouvernement Egyptien
par Décret Royal en date du 15 Mai 1923

Année 1937

21

LE CAIRE
IMPRIMERIE P. BARBEY
—
1938

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D'ÉGYPTE

TRENTIÈME ANNÉE

VINGT-ET-UNIÈME VOLUME

1937

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1938

Les opinions émises dans les publications de la Société sont propres à leurs auteurs. La Société n'en assume aucunement la responsabilité.

Date de parution et de distribution du présent Volume :

31 Mars 1938

Le Rédacteur en Chef :
A. ALFIERI.

DECRET APPROUVANT LES STATUTS DE LA SOCIETE ROYALE ENTOMOLOGIQUE D'EGYPTE (1).

Nous, Roï d'Egypte,

Considérant le but élevé pour lequel a été fondée la Société Royale Entomologique d'Egypte ;

Considérant l'opportunité d'encourager et de seconder les travaux de la dite Société ;

Sur la proposition du Président de Notre Conseil des Ministres et l'avis conforme du dit Conseil ;

DECRETONS :

Art. 1er. — La Société Royale Entomologique d'Egypte est placée sous le Haut Patronage du Gouvernement Egyptien.

Les statuts annexés au présent Décret sont approuvés (2).

Art. 2. — Le Président du Conseil des Ministres est chargé de l'exécution de Notre présent Décret.

Fait au Palais d'Abdine, le 29 Ramadan 1341.
(15 Mai 1923).

FOUAD.

Par le Roi :
Le Président du Conseil des Ministres,
YEHIA IBRAHIM.

(*Traduction*).

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(1) Ce Décret a été publié dans le *Journal Officiel* du Gouvernement Egyptien, numéro 77, en date du Jeudi 2 Août 1923.

(2) Le texte complet des statuts est également publié dans le Bulletin de cette Société, année 1922.

MEMBRES BIENFAITEURS :

1924 M. Moustapha El Salanikli Bey, de Damanhour (Béhéra).

1925 S.E. El Sayed Fathalla Mahmoud Pacha, de Rahmania (Béhéra).

» M. Riad Abdel Kawi El Gebali Bey, de Chebin El Kom (Menoufia).

» S.E. Georges Wissa Pacha, d'Assiout (Haute-Egypte).

» M. Yehia Kawalli Bey, de Minieh (Haute-Egypte).

» M. Yacoub Bibawi Attia Bey, de Minieh (Haute-Egypte).

» S.E. Hassan Charawi Pacha, de Minieh (Haute-Egypte).

» S.E. Habib Chenouda Pacha, d'Assiout (Haute-Egypte).

» M. Mohamed Tewfick Mohanna Bey, de Tewfikieh (Béhéra).

» M. Hassan Ahmed Moussa Bey, de Minieh (Haute-Egypte).

» M. Labib Barsoum Hanna Bey, de Minieh (Haute-Egypte).

» S.E. Hassan Mohamed El Tahtawi Pacha, de Guirgheh (Haute-Egypte).

» M. Kassem Osman El Labban Bey, de Guirgheh (Haute-Egypte).

» M. Dordeir El Sayed Ahmed El Ansari Bey, de Guirgheh (Haute-Egypte).

» M. Barsoum Said Abdel Messih Bey, de Minieh (Haute-Egypte).

» M. Dordeir Taha Abou Gounema Bey, de Minieh (Haute-Egypte).

1926 M. Mohamed Rifaat El Roznamgy Bey.

1927 M. le Dr. Walter Innes Bey, †.

» M. le Dr. Avocat Giovanni Ferrante, du Caire.

1928 M. Hassan C. Efflatoun Bey, du Caire.

» M. Hugo Lindeman, †.

1932 M. Alfred Reinhart, †.

Membres du Conseil de la Société Royale Entomologique d'Egypte en 1937 :

Siège Vacant, *Président.*

M. le Prof. Dr. Herman Priesner, *Vice-Président.*

M. le Prof. Hassan C. Efflatoun Bey, *Vice-Président.*

M. Anastase Alfieri, *Secrétaire-Général.*

M. Richard Wilkinson, *Trésorier.*

S.E. Fouad Abaza Pacha.

M. Said Bahgat Bey.

M. Edgard Chakour.

M. le Dr. Kamel Mansour.

M. Abdel Megid El Mistikawy.

M. le Dr. Hamed Seleem Soliman.

M. le Prof. Guido Torriani.

Comité Scientifique :

M. le Prof. Dr. H. Priesner, M. le Prof. Hassan C. Efflatoun Bey, M. le Dr. Kamel Mansour, M. Anastase Alfieri.

Censeurs :

M. le Dr. A. Azadian et M. E. Kaourk.

BULLETIN

DE LA

SOCIÉTÉ ROYALE ENTOMOLOGIQUE D'ÉGYPTE

Liste des Membres de la Societé en 1937

(Les noms des Membres Fondateurs sont précédés de la lettre F)

Vice-Président Honoraire

F FERRANTE (Dr. Avocat Giovanni), 14, Rue El Nemr, au Caire.

Membres Honoraires

1908 ALLUAUD (Charles), Les Ouches, à Crozant (Creuse), France.

» BUGNION (Dr. Edouard), « La Luciole », Avenue Pasteur, Aix en Provence (Bouches du Rhône), France.

1924 EBNER (Prof. Richard), 3, Beethovengasse, Vienne IX, Autriche.

1909 MARCHAL (Dr. Paul), 45, Rue de Verrières, à Antony (Seine), France.

1917 NAVAS (R. P. Longin), Colegio del Salvador, Apartado 32, Zaragoza, Espagne.

1929 PARENT (l'Abbé O.), Institution Ste Marie, Aire sur la Lys, Pas de Calais, France.

» PEYERIMHOFF DE FONTENELLE (P. de), 87. Boulevard Saint-Saëns, Alger, Algérie.

1908 PIC (Maurice), à Digoin (Saône et Loire), France.

1921 PIERRE (Claude), 7 bis, Rue du Loing, Paris (XIV^e), France.

1936 SEIF EL-NASR Pacha (S.E. AHMED HAMDI), Ministre de l'Agriculture, Rue Khosro Pacha, Helouan, près le Caire.

1929 Théry (André), Laboratoire d'Entomologie, Museum National d'Histoire Naturelle, 45 bis, Rue de Buffon, Paris (V°), France.

1920 Tonnoir (André), Senior Research Officer, Division of Economic Entomology, Council for Scientific and Industrial Research, P.O. Box 109, Canberra, F.C.T., Australia.

» Villeneuve (Dr. Joseph), Rue des Vignes, Rambouillet (Seine et Oise), France.

F' Willcocks (F.C.), « Brambles », Hurst Lane, Sedlescombe (near Battle), Sussex, Angleterre.

Membres Correspondants

1932 Alfken (J.D.), 18, Delmestrasse, Brême, Allemagne.

» Ballard (Edward), Government Entomologist, Department of Agriculture and Forests, Jerusalem, Palestine.

1924 Cros (Dr. Auguste), 6, Rue Dublineau, Mascara, Algérie.

1928 D'Orchymont (A.), 176, Avenue Houba de Strooper, Bruxelles (II), Belgique.

1924 Falcoz (Dr. Louis), 71, Rue de la Gare, Lyon-Villeurbanne, France.

» Flower (Major Stanley Smyth), Tring, Herts, Angleterre.

1934 Gadeau de Kerville (Henri), 7, Rue du Passage Dupont, Rouen, France.

1926 Hall (W.J.), Superintendent of the Mazoe Estate and Experimental Station, B.S.A. Company Citrus Estate, Mazoe, Southern Rhodesia, South Africa.

1923 Hervé-Bazin (Prof. Dr. J.), Le Patys, par Segré (Maine et Loire), France.

1924 Hindle (Dr. Prof. Edouard), Magdelene College, Cambridge, Angleterre.

1931 Horn (Dr. Walther), Deutsches Entomologisches Institut, Gossler Str. 20, Berlin-Dahlem, Allemagne.

1923 Hustache (A.), Pensionnat St. Laurent, à Lagny (Seine et Marne), France.

1925 KIRKPATRICK (Thomas Winfrid), East African Agricultural Research Station, Section of Entomology, Amani (via Tanga), Tanganyika Territory, British East Africa.

1934 KOCH (C.), c/o Monsieur Georges Frey, Widenmayerstrasse 51/III, Munich, Allemagne.

1929 MASI (L.), Museo Civico di Storia Naturale « Giacomo Doria », 9, Via Brigata Liguria, Genova (102), Italie.

1930 MELLOR (J.E.M.), The Prospect Cottage, Bredwardine, Herefordshire, Angleterre.

1934 PAOLI (Prof. Guido), Directeur du R. Osservatorio per le Malatie delle Piante, 1, Via Marcello Durazzo, Gênes, Italie.

» SCHATZMAYR (Prof. A.), Directeur du Musée Entomologique « Pietro Rossi » de S.A.S. le Prince Alexandre della Torre e Tasso, Duino (près Monfalcone), Italie.

1927 WILLIAMS (C.B.), Rothamsted Experimental Station, Harpenden, Angleterre.

Membres Titulaires

1913 ABAZA Pacha (S.E. Fouad), Boîte Postale N° 63, au Caire.

1933 ABDEL MALEK (Ragheb), Entomologiste, Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1925 AGRICULTURAL SCHOOL MIKVEH-ISRAEL, P.O. Box 185, Tel-Aviv, Palestine.

1909 ALFIERI (Anastase), Boîte Postale N° 430, au Caire.

1924 AZADIAN (Dr. A.), Laboratoires d'Hygiène Publique, au Caire.

1908 BAHARI Bey (G.C.), 11, Rue Seif el Dine El Mahrani, Fagala, au Caire.

1928 BAHGAT Bey (Said), Boîte Postale N° 63, au Caire.

1929 BICHARA (Ibrahim), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1937 BIGGS (H.E.), 12, Tera El Boulaquieh, au Caire.

1934 BITTAR (Andrew), 45, Rue Ibrahim Pacha, Bittar Building, au Caire.

1923 Bodenheimer (Prof. F.S.), Directeur du Département de Zoologie Générale et d'Entomologie, Université Hébraïque, Boîte Postale No. 340, Jérusalem, Palestine.

1933 Calzolari (Emilio), Ingénieur Agronome, 28, Rue Chérif Pacha, Alexandrie.

1929 Cassab (Antoine), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

F Chakour (Edgard), Secrétaire Général de la Société Anonyme des Eaux du Caire, Rue Foum El-Teraa El-Boulakia, au Caire.

1933 Chazette (Fernand), Professeur de Sciences Naturelles, Lycée Français, 2-4, Rue Haouayati, au Caire.

1931 Compagnie Universelle du Canal Maritime de Suez, Kasr el Doubara, au Caire.

1934 Crédit Foncier Egyptien (Monsieur l'Administrateur Délégué), Rue Manakh, au Caire.

1928 Dollfus (Robert Ph.), Museum National d'Histoire Naturelle, 57, Rue Cuvier, Paris (V^{me}), France.

1919 Efflatoun Bey (Hassan C.), Professeur d'Entomologie et Vice-Doyen de la Faculté des Sciences, Université Egyptienne, Abbassieh, au Caire.

1920 Efflatoun Pacha (S.E. Mohamed), Meadi, près le Caire.

1934 Faculté d'Agriculture, Université Egyptienne, Ghizeh, près le Caire.

1933 Frangopoulos (A.M.), B.A., B.Sc., Assistant Government Entomologist, Nicosia, Cyprus.

1936 Fund Bib-ka Sredne-Asiatsk. Gos. Universiteta, Potchtovij jaschtik, No. 47, Taschkent, U.S.S.R.

1914 Garboua (Maurice), 8, Rue Kasr el Nil, au Caire.

1907 Garozzo (A.S.), Ingénieur, 6, Rue Deir El Banat, au Caire.

1927 Ghali Pacha (S.E. Wacef Boutros), Avenue de Ghizeh, près le Caire.

1935 Glyki (Marc), Ingénieur-Chimiste, Bureau Technique Agricole et Industriel, 2, Rue du Télégraphe Anglais, Alexandrie.

1921 Greiss (Elhamy), Département Botanique, Faculté des Sciences, Université Egyptienne, Abbassieh, au Caire.

1936 Hafez Ibrahim (Mahmoud), Démonstrateur au Département de Zoologie, Faculté des Sciences, Université Egyptienne, Abbassieh, au Caire.

1930 Hanafy Bey (Mahmoud), 12, Rue Akhshid, Manial El Roda, près le Caire.

1928 Hassan (Dr. Ahmed Salem), Professeur de Zoologie et d'Entomologie à la Faculté d'Agriculture, Université Egyptienne, Ghizeh, près le Caire.

1932 His Majesty Stationery Office, Princes Street, Westminster, S.W.1, London, Angleterre.

1925 Hocheiry (Abd-El-Baki Zaki El), Conseiller à la Cour d'Appel Indigène, 22, Rue Abou el Feda, Zamalek, au Caire.

1924 Honoré (A.), Chimiste, Raffinerie de Hawamdieh, Haute-Egypte.

1927 Housny (Mahmoud), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1936 Imperial Chemical Industries (Egypt) S.A., 19, Rue Kasr el Nil, au Caire.

1930 Independent Biological Laboratories, 23, Nve Shaanan, P.O. Box 1071, Tel Aviv, Palestine.

1928 Izzet Bey (Mohamed), 14, Midan el Daher, au Caire.

1915 Jullien (Joseph), 248, Rue de Thèbes, Cleopâtra les Bains, Ramleh.

1927 Kamal (Dr. Mohamed), Cotton Research Board, Ministère de l'Agriculture, Ghizeh, près le Caire.

1922 Kaourk (Elias A.), Avocat, 35, Rue Kasr el Nil, au Caire.

1926 Kassem (Mohamed), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1937 Koeber (H.), Ingénieur, Directeur des Carrières Gouvernementales, Abou Zaabal, Basse-Egypte.

1923 Laboratoires d'Hygiène Publique, Bibliothèque de la Section d'Helminthologie, au Caire.

1931 Land Bank of Egypt (Mons. l'Administrateur-Directeur de la), Boîte Postale No. 614, Alexandrie.

1923 Librarian, Agricultural Research Service, Wad Medani, Soudan.

1921 Limongelli (Mme Vve C. Artin D.), 5, Midan Cheikh Youssef, Kasr el Doubara, au Caire.

1934 Lotte (Dr. F.), Boîte Postale No. 222, Port-Said.

1937 Loutfy (Abdel Aziz), Professeur d'Entomologie, Ecole d'Agriculture, Chebin El Kom, Basse-Egypte.

1931 Lycées Français, 2-4, Rue Haouayati, au Caire.

1932 Madwar (Dr. Saadallah Mohamed), Research Institute and Endemic Diseases Hospital, 10, Rue Kasr El Aini, au Caire.

» Malouf (N. S. Royston), Osborn Zoological Laboratory, Yale University, New Haven, Connecticut, Etats-Unis d'Amérique.

1927 Mansour (Dr. Kamel), Professeur-adjoint, Département de Zoologie, Faculté des Sciences, Abbassieh, au Caire.

1921 Mistikawy (Abdel Megid El), Sous-Directeur de la Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1933 Mochi (Alessandro), 119, Avenue Malika Nazli, au Caire.

1929 Mosseri (Henri), 25, Rue Cheikh Abou El Sebaa, au Caire.

1931 Papayoannou (Prof. Dr. Théodore), Hôpital Papayoannou, Boulac El Dacrour, Ghizeh, près le Caire.

1911 Petroff (Alexandre), 15, Boulevard Saad Zagloul, Alexandrie.

1928 Priesner (Prof. Dr. H.), Directeur de la Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1932 Rivnay (E.), Institute of Agriculture and Natural History, Agricultural Experiment Station, P. O. Box 121, Tel Aviv, Palestine.

1925 Royal Entomological Society of London (The), 41, Queen's Gate, South Kensington, S.W. 7, Londres, Angleterre.

1924 Shaw (Fred), Maadi, près le Caire.

1921 Société Royale d'Agriculture, Laboratoire d'Entomologie de la Section Technique, Boîte Postale No. 63, au Caire.

1934 Soliman (Dr. Hamed Seleem), Faculté d'Agriculture, Université Egyptienne, Ghizeh, près le Caire.

1928 Soliman (Dr. Labib Boutros), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1936 Taher El Sayed (Dr. Mohamed), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1933 Taihoku Imperial University Library (The), Taihoku, Formosa, Japon.

1926 Tewfik (Mohamed), Assistant Entomologiste, Faculté des Sciences, Université Egyptienne, Abbassieh, au Caire.

1933 Torriani (Guido), Professeur de Sciences Naturelles aux Ecoles Royales Moyennes Italiennes, Appartement No. 38, 42, Rue Soliman Pacha, au Caire.

1935 Tractor Company of Egypt, S.A.E. (The), 140, Rue Emad El Dine, Boîte Postale No. 366, au Caire.

1923 Vallet (Jean), Avocat, Immeuble Rabbat, Avenue Fouad Ier, au Caire.

1926 Waly (Dr. Mohamed), Conférencier en Zoologie, Faculté des Sciences, Université Egyptienne, Abbassieh, au Caire.

1912 Wilkinson (Richard), Pyramid House, 24, Rue Saraya El Gezira, Zamalek, au Caire.

1915 Zoological Service, Ghizeh, près le Caire.

1926 Zulficar (Samir), Maadi, près le Caire.

Institutions Scientifiques et Bibliothèques

Afrique Occidentale Française:

Monsieur le Gouverneur Général (Comité d'Etudes Historiques et Scientifiques), Dakar, Sénégal.

Afrique du Sud:

South African Museum, P.O. Box 61, Cape Town.

Department of Agriculture of the Union of South Africa (The Agricultural Journal of the Union of South Africa), Pretoria.

Department of Agriculture of the Union of South Africa, Division of Entomology, P.O. Box 513, Pretoria.

Algérie:

Société d'Histoire Naturelle de l'Afrique du Nord, Faculté des Sciences d'Alger, Alger.

Allemagne:

Deutsche Entomologische Gesellschaft, 43, Invalidenstrasse, Berlin (IV).

Senckenbergischen Naturforschenden Gesellschaft, Bibliothek, Viktoria Allee 9, Frankfurt A/M.

Bücherei des Zoologischen Museums, 43, Invalidenstrasse, Berlin (IV).

Gesellschaft für Vorratsschutz E.V. (Mitteilungen der), 31, Zimmermannstrasse, Berlin-Steglitz.

Bücherei der Biologischen Reichsanstalt für Land- und Forstwirtschaft, 19, Königin-Luise-Str., Berlin-Dahlem.

Deutches Entomologisches Institut (Arbeiten über morphologische und taxonomische Entomologie), 20, Gossler Strasse, Berlin-Dahlem.

Deutsche Kolonial und Uebersee-Museum, Bahnhofsplatz, Brême.

Angleterre:

The Imperial Institute of Entomology, Review of Applied Entomology, 41, Queen's Gate, London S.W. 7.

Zoological Museum (Novitates Zoologicæ), Tring Park, Tring, Herts.

The Apis Club (The Bee World), The Way's End, Foxton, Royston, Herts.

The Philosophical Society of Cambridge, Zoological Laboratory, The Museums, Cambridge.

The Librarian, The Zoological Society of London, Zoological Gardens, Regent's Park, London, N.W.8.

The Librarian, Department of Entomology, University Museum, Oxford.

Argentine :

Instituto Biologico de la Sociedad Rural Argentina, Buenos Aires.

Sociedad Cientifica Argentina, Calle Santa Fé, 1145, Buenos Aires.

Sociedad Entomologica Argentina, Museo Nacional de Historia Natural, Buenos Aires.

Museo Nacional de Historia Natural « Bernadino Rivadavia », Casilla de Correo N° 470, Buenos Aires.

Ministerio de Agricultura (Boletin del Ministerio de Agricultura de la Nacion), Bibliotheca, 974, Paseo Colon, Buenos Aires.

Australie :

The Australian Museum (Records of the Australian Museum), Sydney, N.S.W.

The Entomologist's Office, Department of Agriculture, Sydney, N.S.W.

The Public Library, Museum, and Art Gallery of South Australia, Box 386 A, G.P.O., Adelaide, South Australia.

The Library of the Division of Economic Entomology, P.O. Box No. 109, Canberra City, F.C.T.

The Linnean Society of New South Wales, Science House, Gloucester and Essex Streets, Sydney, N.S.W.

Autriche :

Administration-Kanzlei des Naturhistorischen Museums, Burgring 7, Vienne (I).

Zoologisch-Botanische Gesellschaft, 2, Mechelgasse, Vienne (III).

Koleopterologische Rundschau, c/o Zoologisch-Botanische Gesellschaft, 2, Mechelgasse, Vienne (III).

Belgique :

Société Entomologique de Belgique, 31, Rue Vautier, Bruxelles.

Société Scientifique de Bruxelles, Secrétariat, 2, Rue du Manège, Louvain.

Monsieur A. Moureau, Secrétaire du Bulletin de l'Institut Agronomique et des Stations de Recherches de Gembloux, Institut Agronomique de l'Etat, Gembloux.

Lambillionea, Revue Mensuelle de l'Union des Entomologistes Belges (M. F. Derenne), 123, Avenue de la Couronne, Ixelles (Bruxelles).

Annales du Musée du Congo Belge, Tervueren.

Association des Ingénieurs sortis de l'Institut Agronomique de l'Etat, à Gembloux, 35, Avenue des Volontaires, Anderghem-Bruxelles.

Brésil:

Museu National do Rio de Janeiro, Rio de Janeiro.

Instituto Biologico, Bibliotheca, Caixa Postal 2821, São Paulo.

Instituto Oswaldo Cruz, Caixa de Correio 926, Rio de Janeiro.

Instituto de Biologia Vegetal, Jardim Botanico, Rio de Janeiro.

Bulgarie:

Institutions Royales d'Histoire Naturelle, Musée Royal d'Histoire Naturelle, Palais Royal, Sofia.

Société Entomologique de Bulgarie, Musée Royal d'Histoire Naturelle, Palais Royal, Sofia.

Société Bulgare des Sciences Naturelles, Musée Royal d'Histoire Naturelle, Palais Royal, Sofia.

Canada:

Entomological Society of Ontario (The Canadian Entomologist & Reports), Guelph, Ontario.

Library, Department of Agriculture, West Block, Ottawa.

Department of Agriculture, Entomological Branch, Ottawa.

Nova Scotian Institute of Science, Halifax.

Chine:

The Lingnan Science Journal, Lingnan University, Canton.

Bulletin of the Biological Department, Science College, National Sun Yat-Sen University, Canton.

Bureau of Entomology of the Chekiang Province, West Lake, Hangchow.

Chypre:

The Cyprus Agricultural Journal (The Office of the Governement Entomologist), Nicosia.

Cuba:

Sociedad Cubana de Historia Natural « Felipe Poey » (Memorias), c o Dr. Carlos Guillermo Agnayo, 25 N° 254, Vedado, La Havane.

Danemark:

Entomologisk Forening, Zoologisk Museum, Krystalgade, Copenhague.

Egypte:

Bibliothèque du Cabinet de S.M. le Roi, Palais d'Abdine, au Caire.

Bibliothèque privée de S.M. le Roi, Palais d'Abdine, au Caire.

Ministère de l'Agriculture, Bibliothèque de la Section d'Entomologie, Dokki (Ghizeh), près le Caire.

Société Royale d'Agriculture, Bibliothèque de la Section Technique, Boîte Postale N° 63, au Caire.

Union des Agriculteurs d'Egypte, 25, rue Cheikh Abou El Sebaa, au Caire.

The Bee Kingdom, 9, rue El Moez, Matarieh, près le Caire.

Bibliothèque Centrale, Cotton Research Board, Ministère de l'Agriculture, Ghizeh, près le Caire.

Al-Fellaha, Boîte Postale N° 2047, au Caire.

Société Royale de Géographie d'Egypte, 45, rue Cheikh Youssef, au Caire.

Ministère de l'Instruction Publique, Directeur des Dépôts, Section des Journaux et Revues, Rue El Falaki, au Caire.

The Journal of the Egyptian Medical Association, 5, rue El Sanafiri, Abdine, au Caire.

Société Royale d'Economie Politique, de Statistique et de Législation, Boîte Postale N° 732, au Caire.

Institut d'Égypte, 1, rue Cheikh Rihan, au Caire.

Bibliothèque Nationale Égyptienne, Midan Bab El Khalq, au Caire.

Bibliothèque du Musée Agricole Fouad Ier, c/o Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

Bibliothèque de la Faculté de Médecine, University Égyptienne, au Caire.

Bibliothèque de la Faculté des Sciences, Université Égyptienne, Abbassieh, au Caire.

Equateur (République de l'), Amérique du Sud:

Director General de Agricultura (Revista del Departamento de Agricultura), Quito.

Boletin de la Seccion Agricola del Banco Hipotecario del Ecuador, Apartado 685, Quito.

Espagne:

Instituto Nacional de 2ª Ensenanza de Valencia, Laboratorio de Hidrobiologia Espanola, Valencia.

Junta para ampliacion de Estudios e Investigaciones Cientificas, 4, Duque de Medinaceli, Madrid.

Junta de Ciencies Naturales de Barcelona, Museo Municipal, Barcelona.

Academia de Ciencias y Artes de Barcelona, Barcelona.

Sociedad Espanola de Historia Natural, Museo Nacional de Ciencias Naturales, Hipodromo, Madrid (VI).

Estacion de Patologia Vegetal, Instituto Nacional Agronomico, La Moncloa, Madrid (VIII).

Etats-Unis:

Buffalo Society of Natural Sciences, Buffalo Museum of Science, Humboldt Park, Buffalo, New-York.

University of Illinois Library, Exchange Division, Urbana, Illinois.

Library of the American Museum of Natural History, Central Park, New-York City.

Pacific Coast Entomological Society (The Pan-Pacific Entomologist), California Academy of Sciences, Golden Gate Park, San Francisco, California.

Academy of Natural Sciences, Entomological Section, Lagon Square, Philadelphia.

Experiment Station of the Hawaiian Sugar Planters' Association, P.O. Box 411, Honolulu, T.H., Hawai.

Hawaiian Entomological Society, c/o Experiment Station of the Hawaiian Sugar Planters' Association, P.O. Box 411, Honolulu, T.H., Hawai.

Carnegie Museum, Department of the Carnegie Institute, Pittsburgh, Pennsylvania.

American Entomological Society, Academy of Natural Sciences, Lagon Sqnare, Philadelphia, Pa.

United States Department of Agriculture, Washington, D.C.

General Library, University of Michigan, Ann Arbor, Michigan.

United States National Museum, Smithsonian Institution, Washington, D.C.

University of California Library, Berkeley, California.

Library of the New-York State College of Agriculture and Agricultural Experiment Station, Cornell University, Ithaca, New-York.

Smithsonian Institution, Washington, D.C.

New-York Academy of Sciences, New-York.

Pennsylvania State Health Department, Pennsylvania.

Entomological Society of Washington, Washington.

Graduate School of Tropical Agriculture and Citrus Exprimental Station, Riverside, California.

Wisconsin Academy of Sciences, Arts, and Letters, Madison, Wisconsin.

Library, Minnesota Agricultural Experiment Station, University Farm, Saint Paul, Minnesota.

Museum of Comparative Zoology, Harward College, Cambridge, Mass.

The Philippine Agriculturist, Library, College of Agriculture, Agricultural College, Laguna, Philippine Islands.

Editorial Office, The American Midland Naturalist, University of Notre Dame, Notre Dame, Indiana.

Marine Biological Laboratory, Library, Woods Hole, Mass.

Finlande:

Societas Entomologica Helsingforsiensis, Helsinki.

Societas pro Fauna et Flora Fennica, Kaserngatan 24, Helsinki.

Societas Zoolog.-Botanica Fennica Vanamo, Fabiani 22, Helsinki, Suomi.

Société Entomologique de Finlande (Annales Entomologici Fennici), Institut de Zoologie Agricole et Forestière de l'Université, Snellmaninkatu 5, Helsinki.

France:

L'Echange, Revue Linnéenne, Digoin (Saône et Loire).

Revue Scientifique du Bourbonnais et du Centre de la France, 22, Avenue Meunier, Moulins (Allier).

Société d'Etudes des Sciences Naturelles de Nîmes, 6, Quai de la Fontaine, Nîmes (Gard).

Société de Pathologie Végétale et d'Entomologie Agricole de France, Laboratoire de Pathologie Végétale, Institut National Agronomique, 16, Rue Claude Bernard, Paris (V°).

Société Linnéenne de Bordeaux, Athénée, 53, rue Des Trois Conils, Bordeaux.

Société Linnéenne de Lyon, 33, rue Bossuet (Imm. Municipal), Lyon.

Société des Sciences Naturelles de l'Ouest de la France, Nantes (Loire Inférieure).

Association des Naturalistes de Levallois-Perret, 153, rue du Président Wilson (Domaine de la Planchette), Levallois-Perret (Seine).

Société Linnéenne du Nord de la France, 81, rue Lemerchier (M. Pauchet), Amiens.

Société Géologique de Normandie et des Amis du Museum du Havre, Hôtel des Sociétés Savantes, 56, rue Anatole France, Le Havre (Seine Inférieure).

Société d'Histoire Naturelle de Toulouse, Bibliothèque Universitaire de la Faculté de Médecine, Allée Saint-Michel, Toulouse.

Société Entomologique de France, Institut National Agronomique, 16, Rue Claude Bernard, Paris (V°).

Société d'Etudes Scientifiques de l'Aude, Carcassone (Aude).

Annales des Epiphyties et de Phytogénétique, Centre National des Recherches agronomiques, à Versailles, France.

Museum National d'Histoire Naturelle, Bibliothèque, 8, Rue de Buffon, Paris (V^e).

Société de Zoologie Agricole (Revue de Zoologie Agricole et Appliquée), Faculté des Sciences, Institut de Zoologie, Cours de la Marne, Bordeaux.

Grèce :

Institut Phytopathologique Benaki, Kiphissia (près Athènes).

Bibliothèque de l'Institut et Musée Zoologique de l'Université, Athènes.

Hollande :

Nederlandsche Entomologische Vereeniging, p/a Zoölogisch Museum, Amsterdam.

Landbouwhoegeschool Laboratorium voor Entomologie, Berg 37, Wageningen.

Hongrie :

Magyar Nemzeti Muzeum (Allattar), Museum Nationale Hungaricum, Sectio Zoologica, Budapest 80.

Indes :

Zoological Survey of India (Records of the Indian Museum), Indian Museum, Calcutta.

Madras Governement Museum, Connemara Public Library, Egmore, Madras.

Agricultural Research Institute, Library, Pusa, Bihar.

Agricultural Research Institute, Entomological Section, Pusa Bihar.

Indes Néerlandaises :

Instituts Scientifiques de Buitenzorg's Lands Plantentuin (Treubia), (den Directeur van Landbouw, Nijverheid en Handel), Buitenzorg, Java.

Italie :

Museo Civico di Storia Naturale « Giacomo Doria », 9, Via Brigata Liguria, Genova (102).

Museo Civico di Storia Naturale di Trieste (Atti del), 4, Piazza Hortis, Trieste (10).

Società dei Naturalisti in Napoli, Reale Università, Via Mezzocannone, Napoli.

Società Entomologica Italiana, Museo Civico di Storia Naturale, 9, Via Brigata Liguria, Genova (102).

Società Adriatica di Scienze Naturali, 7, Via dell'Annunziata, Trieste.

La Reale Stazione di Entomologia Agraria (Redia), 19, Via Romana, Firenze (32).

La Reale Stazione Sperimentale di Gelsicoltura e Bachicoltura di Ascoli Piceno.

Istituto Zoologico della Reale Università di Napoli, Napoli.

Laboratorio di Zoologia Generale e Agraria, Napoli (Portici).

Bibliothèque de l'Institut International d'Agriculture (Moniteur International de la Protection des Plantes), Villa Umberto I, Rome (110).

Società italiana di Scienze Naturali, Palazzo del Museo Civico di Storia Naturale, Corso Venezia, Milano.

Istituto di Zoologia della Reale Università di Genova (Bollettino dei Musei di Zoologia e di Anatomia comparata), 5, Via Balbi, Genova.

Società dei Naturalisti e Matematici di Modena, presso la Reale Università, Modena.

Istituto di Entomologia della Reale Università, 6, Via Filippo Re, Bologna (125).

Reale Accademia di Scienze, Lettere e Arti di Padova, Padova (Veneto).

Museo di Storia Naturale della Venezia Tridentina (« Memorie del Museo di Storia Naturale della Venezia Tridentina » e « Studi Trentini di Scienze Naturali »), Casella Postale 95, Trento.

Instituto Agricolo Coloniale Italiano, 9, Viale Principe Umberto, Firenze (8).

Museo Entomologico « Pietro Rossi », Duino (presso Monfalcone).

Società Veneziana di Storia Naturale (presso Sig. Antonio Giordani Soika), S. Marco 254, Venezia.

Japon:

Saghalien Central Experiment Station, Konuma, Saghalien.

The Ohara Institute for Agricultural Research, Library, Kurashiki, Okayama-Ken.

Imperial Agricultural Experiment Station (Journal of the), Nishigahara, Tokyo.

Departement of Agriculture, Government Research Institute, Taihoku, Formosa.

The Kansai Entomological Society, Cho Teranishi: 221 Ikue-chc, Higashinari-ku, Osaka.

Kenya:

East Africa and Uganda Natural History Society, Coryndon Memorial Museum, P.O.Box 658, Nairobi, Kenya Colony, British East Africa.

Maroc:

Société des Sciences Naturelles du Maroc, Institut Scientifique Chérifien, Avenue Biarnay, Rabat.

Défense des Végétaux, Service de l'Agriculture et de la Colonisation, Direction des Affaires Economiques, Rabat.

Mexique:

Junta Nacional Directora de la Campana contra la Langosta (Junosta), Biblioteca, Departamento Directivo, Veracruz.

Bibliotheca del Instituto Biotecnico, Calzada Mexico-Tacuba N° 295, Col. Anahuac, D.F.

Bibliotheca del Instituto de Biologia, Universidad Nacional Autonoma, Chapultepec (Casa del Lago), Mexico, D.F.

Norvège:

Tromso Museum Library, Tromso.

Panama (République de):

Departamento Seccional de Agricultura (Boletin Agricola), Panama.

Pologne:

Musée Zoologique Polonais, Krakowskie Przedmiescie 26/28, Varsovie.

Société Polonaise des Entomologistes, Rutowskiego 18, Lwow.

Institut de Recherches des Forêts de l'Etat, Wawelska 54, Varsovie.

Portugal:

Société Portugaise des Sciences Naturelles, Instituto de Fisiologia, Faculdade de Medicina, Lisbonne.

Museum Zoologique de l'Université de Coimbra, Largo Marquês de Plombal, Coimbra.

Roumanie:

Société Transylvanienne des Sciences Naturelles (Siebenbürgischer Verein für Naturwissenschaften), Hermannstadt, Sibiu.

Academia Romana, Bibliothèque, Calea Victoriei, 125, Bucarest.

Russie (U.S.S.R.):

Société Entomologique de Russie (Revue Russe d'Entomologie et Horae), Musée Zoologique de l'Académie des Sciences, Léningrad.

Bibliothèque de l'Académie des Sciences de l'Ukraine, 58a, Rue Korolenko, Kiew (Ukraine).

Société des Naturalistes de Kiew, 37-10, Rue Korolenko, Kiew (Ukraine).

Institut des Recherches Biologiques de l'Université de Perm, Perm II, Zaimka.

Institute for Plant Protection, Bureau of Applied Entomology and Zoology, Library, 10, Elagin Ostrov, Léningrad.

Rédaction du Journal « Plant Protection », 7, Rue Tschaikovsky, Leningrad.

Institute for controlling Pests and Diseases, Library, 7, Tschaikovsky Str., Leningrad 28.

Siam:

Department of Agriculture and Fisheries, Entomology Section, Bangkok.

Suède:

K. Swenska Vetenskapsakademien i Stockholm, Stockholm 50.

Entomologiska Foreningen, Brottninggatten 94, Stockholm.

Göteborgs Kungl. Vetenskaps-och Vitterhets Samhälles, Göteborg.

Statens Växtskyddsanstalt, Stockholm 19.

Bibliothèque de l'Université de Lund, Lund.

Suisse :

Bibliothèque de la Société Entomologique Suisse, Musée d'Histoire Naturelle, Berne.

Zentralbibliotek, Naturforschenden Gesellschaft, Zurich.

Tchéco-Slovaquie :

Societas Entomologica (Casopis), u Karlova 3, Prague II.

Section Entomologique du Musée National de Prague (Sbornik), Vaclavské namesti II.-1700, Prague.

Uruguay (République de l') :

Escuela de Veterinaria del Uruguay (Anales de la Escuela de Veterinaria del Uruguay), Itazaingo 1461, Montévideo.

Sociedad de Biologia de Montevideo, Casilla de Correo 567, Montevideo.

Yougo-Slavie :

Societas Entomologica Jugoslavica (Glasnik), 17, Garasaninovo ulica, Belgrade.

Abonnements de la Société

The Transactions and Proceedings of the Royal Entomological Society of London.

The Macrolepidoptera of the World (édité par le Dr. A. Seitz).

Coleopterorum Catalogus (édité par W. Junk - S. Schenkling).

Entomologische Blätter (Zeitschrift für Biologie und Systematik der Käfer), édité par R. Kleine (Stettin).

N.B. — Pour changement d'adresse, erreurs ou omissions, s'adresser à M. le Secrétaire Général de la Société Royale Entomologique d'Egypte, Boîte Postale N° 430, au Caire.

Séance du 25 Janvier 1937

Présidence de Monsieur le Prof. Dr. H. PRIESNER, *Vice-Président.*

Dons à la Bibliothèque :

La Société a reçu les ouvrages ci-dessous mentionnés :

1° De Monsieur A. THERY, de Paris : 7 brochures relatives à ses travaux sur les Buprestides.

2° De Monsieur ANTOINE CASSAB, du Caire : une brochure de son travail : « Preparation and Method of Application of the Zinc Phosphide Bait employed in the Control of the Mole-Cricket *Gryllotalpa* », publié dans le Bulletin No. 175, Service Technique et Scientifique, Section d'Entomologie, Ministère de l'Agriculture, Egypte, 1936.

3° De Monsieur ROYSTON MALŒUF (Etats-Unis d'Amérique) : un separata de chacun de ses récents travaux relatifs à la Physiologie et Chimie biologique du ver de terre, des arthropodes aquatiques et de la grenouille.

4° De Monsieur J. DE BEAUMONT, de Lausanne : 2 separata relatifs à ses études des Hyménoptères Sphécides.

5° De Monsieur le Docteur AUGUSTE CROS, de Mascara (Algérie) : 2 separata de ses récents travaux sur les Meloides et les Buprestides.

Le Conseil remercie.

Démission :

Quittant définitivement l'Egypte, Monsieur le Conseiller RAOUL HOURIET adresse sa démission. Ce distingué collègue faisait partie de la Société depuis 1924.

Eine neue Goldwespe aus dem oestlichen Mittelmeergebiet (*Gonochrysis mochii* nov.) [1]

(mit 2 Text-Figuren)

von Dr. St. Zimmermann, Wien.

Während eines Aufenthaltes am Zoologischen Museum der Universität Berlin im Frühjahre 1936 zeigte mir Professor Dr. H. Bischoff eine in Palästina gefundene Goldwespe der Gattung *Chrysis*, die sich durch eine sehr auffallende Form des Abdomens auszeichnete. Bald nachher hatte ich Gelegenheit, in Linz bei Professor Dr. H. Priesner (Cairo) zwei aus Aegypten stammende, von ihm zur Bestimmung mitgebrachte, sehr ähnliche Tiere zu sehen. Beide Herren hatten die Freundlichkeit mir die Tiere zur Untersuchung zur Verfügung zu stellen, wofür ihnen auch hier bestens gedankt sei.

Das auffallende Merkmal der drei mir vorliegenden Stücke bilden zwei am Vorderrande des 1. Hinterleibsegmentes liegende Höcker, wie sie mir in dieser Ausbildung bisher noch von keiner Goldwespe bekannt sind. Die Ausbildung des Endrandes des 3. Tergites lässt die neue Art in die Gruppe *Gonochrysis* einreihen; es sei bemerkt, dass die ihr innerhalb dieser Gruppe wohl am nächsten stehende Art, *Gonochrysis subsinuata* Marqu., eine Andeutung ähnlicher Buckelbildung am Vorderrande des Abdomens erkennen lässt.

Ein Vergleich des Stückes aus Palästina mit den beiden aus Aegypten ergibt ein Uebereinstimmen aller wesentlichen Merkmale; die vorhandenen Unterschiede berechtigen lediglich zur Annahme rassenmässiger Verschiedenheit.

Gonochrysis mochii mochii nov. — Genae lang, nur wenig konvergierend, Untergesicht daher ziemlich breit. Cavitas facialis ohne Abschlussleiste; die feinere Punktierung der Cavitas geht in die gröbere der Stirne und des Scheitels über. Thorax grob punktiert, am gröbsten auf dem Scutellum, auf den Mesonotum-Seitenfeldern deutlich doppelte Sculptur; Postscutellum gleichmässig verrundet. Abdomen schlank, die beiden ersten Segmente fast

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[1] Bennant nach dem Arzte und Hymenopterensammler Prof. Dr. Alberto Mochi in Cairo.

zylindrisch, das 3. ziemlich lang, nach hinten stark verjüngt. Der Vorderrand des 1. Segmentes ist vorgezogen, im Profil fast überhängend, und trägt in der Mitte oben zwei runde Höcker, die in der Mittellinie eine tiefe Einbucht-

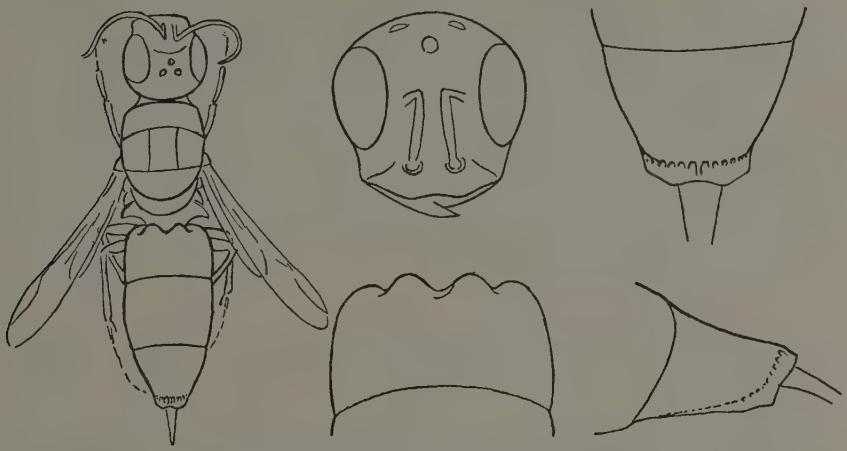


Fig. 1. *Gonochrysis mochii mochii* nov.

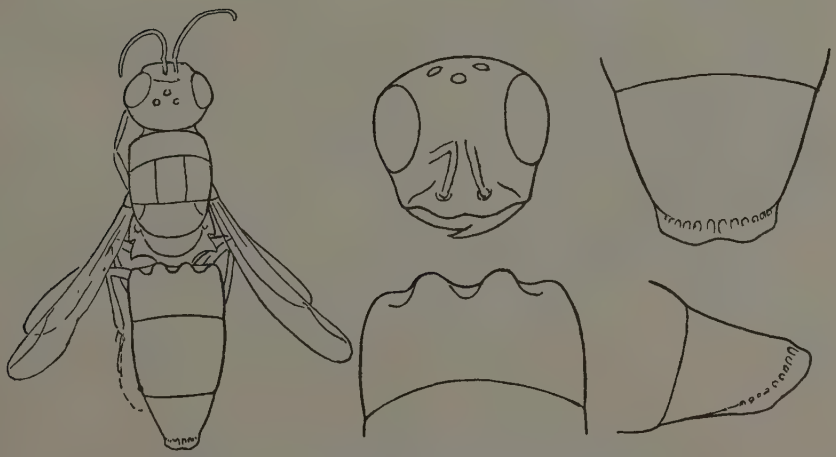


Fig. 2. — *Gonochrysis mochii samariae* nov.

ung einschliessen und ebenso seitlich von einer weniger tiefen Einbuchtung begrenzt sind. Das letzte Segment ist im Profil seiner ganzen Länge nach bis knapp vor die Punktreihe leicht sattelartig eingedrückt und in der Mittel-

linie sehr schwach gekielt. Die Punktreihe besteht aus in der Mitte grossen, gegen die Seitenränder zu kleiner werdenden Punkten und reicht dort bis über die Hälfte des letzten Tergites nach vorne. Der Endrand ist an den Ecken rechtwinkelig vorgezogen, zwischen den beiden Ecken dreimal gebuchtet. Die Punktierung des Abdomens ist dicht; das 1. Segment ist doppelt und etwas gröber als das 2. skulpturiert; Die zweite Hälfte des 3. Segmentes ist schwächer punktiert.

Kopf und Thorax grüngolden, Untergesicht, die seitlichen Hinterecken des Pronotums, die Mesonotum-Seitenfelder und die Epinotaldornen fast reingolden. Abdomen rotgolden, Endrand des 3. Tergites blau. Fühlerschäfte rotgolden, Fühlergeissel fast schwarz. Tibien metallisch, Tarsen dunkelbraun. Flügel leich angeraucht, Radialzelle vollkmomen geschlossen, Behaarung am ganzen Körper hell, ziemlich dicht und namentlich auf Kapf und Thorax lang abstehend.

Länge: 9 mm. — 2 ♀♀.

Fundort: Borgash (kleine Ortschaft im Nildelta), Aegypten, 27.III.35.

Typen in der Sammlung des Ministry of Agriculture in Kairo und in der Sammlung Dr St. Zimmermann, Wien.

Gonochrysis mochii samariae nov. — Grösser und robuster als *mochii* s.str. Genae noch etwas länger; Cavitas facialis seitlich und am unteren Augenrande anliegend weiss behaart. Die Höcker am Vorderrande des 1. Tergites noch stärker ausgebildet. Die Oberflächen-Skulptur etwas gröber als bei *mochii* s.str. sonst wie bei dieser. Seitenecken des 3. Tergits weniger scharf vorgezogen, stumpfwinkelig.

Kopf und Thorax dunkelblau, am dunkelsten auf dem Scheitel und dem Mesonotum-Mittelfeld. Abdomen golden, an den Hinterrändern des 1. und 2. Segmentes mit leichtem Grünschimmer. Endrand des 3. Tergites blau.

Länge: 10 mm. — 1 ♀.

Fundort: Nablus (Samaria), Palästina (coll. Dr. R. Stich), 19.-26.IV.34.

Type in der Sammlung des Zoologischen Museums der Universität Berlin.

Brachymeria femorata Panz. (Hymenoptera-Chalcididae) a primary parasite of the cabbage worm *Pieris rapae* L.

(with Plates I-VI).

by Dr. Mohamed Kamal, B.A., M.S., Ph.D.

Introduction

Brachymeria femorata is an important parasite attacking the fresh pupae of the cabbage worm, *Pieris rapae*. It has been reared from pupae collected from various localities of Lower Egypt and it appears to be a widely distributed parasite of great economic importance. It appears to be a controlling factor of primary importance on the undue increase of the cabbage worm.

On account of the external morphological similarity between the adult of this species and that of closely related species of *Brachymeria* attacking our most important cotton pest, the Pink Boll-Worm, it was deemed necessary to begin our study with the biology of the former due to its prevalence, accessibility and its being easy to breed in confinement.

As a result of long series of dissectioning and microscopic studies it has been found that the immature forms of the few species studied present some homogenity in structure to each other and that the marked differences in the larval development of single species are worthy of mentioning.

In this paper the writer aims to produce in detail the results of investigations on the *B. femorata* independent from its related species hoping in the near future, it would be possible to complete the issue by presenting the bionomics of the latter.

Life History Studies of B. femorata

The adults (Plate I, fig. 1) are slow in their movements and cannot be easily disturbed in their confinement. Their gait together with their yellowish broad femora (Plate I, figs 2 and 3) give them a distinctive appearance.

For breeding purposes, the *Brachymeria* responded very satisfactorily to glass cylinders (6 × 15 cms), closed on one side and covered on the other with light muslin.

Their food consists of droplets of honey placed on oleander leaves. Water is supplied in the form of a wet ball of cotton in the breeding jars.

In each jar we placed two males and four females. Copulation takes place readily and the impregnated female begins to lay her eggs three days after mating. Virgin females were seen to lay eggs but the resulting offspring were all males.

One female is capable of laying several eggs in a single pupa, and it is not uncommon occurrence to observe two females laying at the same time in one pupa. Hyperparasitism occurs quite frequently in confinement and as many as thirteen eggs are counted in one host.

The quota of eggs laid by one female has been partially worked out for few well-cared specimens and it approximately runs on the average around 180 eggs during her life time which lasts about sixty to seventy days under favorable conditions. In actual breeding processes about half this number has been produced.

It has been found that the rate of oviposition is variable and susceptible to wide fluctuations as a result of the change in temperature. Preliminary tests were made to elucidate this point, but without committing ourselves to go into deep details. Summation of these results indicate that parasites kept in confinement at 14° C refused in the majority of cases to lay eggs. Lower degrees, up to 10° C, decreased their energy ; at 18° C, the females presented some energy, laid eggs and the males displayed somewhat depraved appetite for mating. At 20-24° C, however, which appear to offer optimum conditions, both sexes showed a more marked energy in feeding, mating and parasitization. At a temperature of 20-22° C and 60-70° humidity we were able to keep the adult parasites alive for three months. On the other hand when the parasites were subjected to higher temperatures 28-30° C, they displayed abnormal energy, laid less number of eggs and expired quicker.

The adult parasites as well as the other not yet identified species of the Genus *Brachymeria* in Egypt are present in the field from October to the middle of April but are only available in numbers from November to the end of February. During the summer, beginning from May, they disappear, probably they go into aestivation as adults within the pupa of the host.

Number of Generations

Adult *Brachymeria* emerge from the pupae of their host by chewing an irregular hole in the skin almost at or near the middle (Plate I, fig 5). Mating takes place few hours after emergence and it can be activated by exposure for few minutes to a mild sun. Mated females begin egg laying two to three days after emerging.

Compiled data on the life history study of this species indicate that the

time required for the parasite to complete its development from egg to adult varies greatly with the degree of temperature prevailing. In December-January, it takes 56 days at a temperature 19.6° C, January-February 45 days at a temperature of 25.5° C, while in March-April it drops down to 26 days at a temperature of 21.5° C.

The time required by each stage during January-February is as follows: about 3 days in the egg, 4 days in the first larval instar, six days in the second, five days in the third, seven days in the fourth, nine days in the last larval instar and fourteen days in the pupa, thus making a total of 48 days.

Biology of Immature Forms

The Egg

The female *Brachymeria* lays her egg usually in the chrysalid of its host. Fully grown larvae about to pupate were also oviposited in but, generally speaking, fresh pupae are always preferred.

The eggs are found floating in the body cavity at the thoracic region of the host. A parasitized pupa in the early stage does not show any symptom but later, as the parasite advances in development, it changes in color turning brownish, gets lighter in weight and the tiny black spots on the skin decrease in number and intensity. It is quite characteristic of a parasitized chrysalid to find its appendages pressed together and adhering into almost complete fusion to the body.

The egg (Plate II, fig. 7) is 0.9 mm. long and 0.2 mm. wide, cigar-like in shape, slightly curved in the middle and rounded at both ends, the anterior being wider than the posterior, the color is whitish and the chorion is smooth and without pattern. The embryo is opaque and the region where it lies is slightly darker than the rest.

The egg remains where it is laid until it hatches in 48-72 hours at a temperature of 20° C.

The First Instar Larva

The primary larva moves about in the body cavity of its host. With its formidable mandibles the strongest individual is prepared to fight its neighboring competitors in order to remain the sole occupant of the host. In all cases of hyperparasitism observed by the writer only one larva develops to maturity. In few cases two larvae were seen to develop to the second instar but only one parasite larva ever completes development in a single host pupa.

The first instar larva, regardless of being a true internal parasite, bears resemblance particularly in the number of body segments and in the presence of open spiracles, to those of ectoparasitic forms. This, perhaps, may be due

to the habit of feeding on the top of the internal organs of the host rather than being submerged in the body contents.

The first instar larva (Plate II, fig. 8) measures about 2.0 mm. in length and 0.47 mm. in breadth, with body tapering posteriorly from the seventh abdominal segment. The body is slender and composed of thirteen well-differentiated segments. The last caudal segment is shorter and almost as long as wide and slightly invaginated at the bottom, thus giving the impression of being bilobed and helping to recognize this stage.

The head (Plate II, figs 9 and 13) is well defined, and its size is about one and one-half times as long as the first thoracic segment; a little wider than long, slightly chitinized, bears no capsule, and carries dorso-laterally a pair of stubby antennae. The oral orifice is small and located apico-ventrally on a fleshy protuberance. The head bears a pair of strong curved mandibles (Plate II, figs 11 and 12) which are sickle-shaped, highly sclerotized, brownish at the tips, and measure about 0.05 mm. in length. They are very wide at the base, pointed at the tips, and connected to the head with strongly chitinized plates. On the ventral aspect of the head (Plate II, fig. 13) and below the mandibles there is a skeletal semi-circular line below the buccal cavity, extending between the base of the mandibles. It is called the hypopharyngeal bracon in related species. The hypostoma is highly developed and runs in a linear form below the pleurostoma. The transverse tentorial bar is weakly chitinized, and the lateral epicraneal angle is well defined.

There are also two pairs of sensory setae and several sensory pits as illustrated in the diagram (Plate II, fig. 13).

The body of the first instar larva is clothed with dense cuticular spines (Plate III, fig. 16) and sensory setae located on both ventral and dorsal aspects. They are grouped in equidistant bands on each segment and arranged as follows: on the dorsum each segment carries one band beginning with a few on the middle of the third thoracic and ending with a few on the last caudal (as shown in Plate III, fig. 14).

On the venter, however, the spines (Plate III, fig. 15), begin on the first and second thoracic with one band and from the third thoracic to the eighth abdominal segment the spines are arranged in two bands, an upper and a lower one. The latter is smaller and the spines much shorter mostly directed forward; while the upper band is bigger, the spines longer and their direction is backward. The ninth and the tenth abdominal segments differ from the others in having spines distributed on their surfaces as shown in Plate II, fig. 10 rather than being grouped in regular bands.

All segments, except the last on the dorsum, carry two pairs of sensory setae, one pair dorso-marginal and the other ventro-lateral. These setae differ from the spines in being longer, more slender, and in having a rounded and slightly fleshy base.

The digestive System

The alimentary canal is highly developed in the first instar. It is apparently composed of one main tube, sack-like in form, filling almost all the body cavity. This stands for the stomach or the mid-intestine which extends to the 11th segment. The stomach is united anteriorly with a tube, the fore-intestine, which widens a little to form the pharynx. The hind intestine joins the stomach at the tenth abdominal segment but does not open into it. There are two pairs of long capillary tubes attached to the hind intestine known as the Malpighian tubes. The rectum is closed at its connection with the last abdominal segment. The salivary glands are conspicuous tubes running on the sides of the body and uniting near the base of the head.

The Tracheal System

The respiratory system (Plate III, fig. 17) is composed of two highly developed lateral trunks united transversely in the first thoracic segment and posteriorly in the twelvth segment. There are four pairs of spiracles located on the second thoracic and on each of the first three abdominal segments. The spiracles are comparatively very small (Plate III, fig. 18) and the pedicel is slender. The opening is minute and appears as a tiny white spot in the middle. Rudimentary spiracular branches (Plates III, fig. 17) are seen in the third thoracic and the fourth to the seventh abdominal segments. The spiracular branches divide and subdivide into several finer tubes until these ramifications fill the body and head, dorsally as well as ventrally.

The Second Instar Larva

The second instar larva (Plate IV, fig. 19) differs entirely from the first. It measures about 3.0 mm. in length and 1.0 mm. in width. The thirteen body segments are equal in length except the last which is smaller and rounded at its contour. The mandibles (Plate IV, figs 20 and 21) are much larger than those of the first, measuring about 0.75 mm., tip only 0.05 mm., much more slender and curved, base of the mandible much wider.

The spiracular system in this stage is also different from that in the first. The spiracular branches or pedicels which appeared as short rudiments in the latter, are much more highly developed here and bear at their ends in the third thoracic and in the fourth to the seventh abdominal segments small closed spiracles, slightly sclerotized, and not as well pronounced as the true spiracles which are large and open as illustrated in Plate IV, fig. 23. The head is round and short and the skeletal parts are more clearly pronounced. The cuticular spines are arranged dorsally in one band on all the abdominal segments and none on the thorax. Ventrally, however, the spines begin with

one band on the prothorax and mesothorax. The second band starts on the metathorax with but very few spines. The rest of the segments possess bands similar to those in the first instar with the exception of the one before the last (Plate IV, fig. 22) which bears a narrow lower band and a dense upper one. The spines in this stage are much more developed and highly pronounced than in the first.

There are two pairs of sensory setae on each thoracic and abdominal segment. The setae are arranged laterally, above and under the line of spiracles.

The internal anatomy is very much identical with that of the former instar.

The Third Instar Larva

The third instar larva, as shown in Plate V, fig. 24, is similar to the second. It measures 4.5 mm. in length and 0.5 mm. in width. Mandibles (Plate V, figs 26, 27 and 28) stouter, wider at tip and narrower at base, not curved, measuring 0.116 mm. long and the tip 0.053 mm.

There are nine pairs of open spiracles (Plate V, fig. 29) connected with the two lateral trunks by long highly developed branches. The spiracles in this stage (Plate V, fig. 30) are distinguished from the preceding in being wider in diameter and capitate in form, larger and possess longer pedicels. The tenth pair on the eighth abdominal segment is faintly developed and the branch is very short.

The head (Plate V, fig. 25) is similar to that of the second stage and differs in being wider and more sclerotized. The chitinized plates much more defined. The hypopharyngeal bar too is very highly developed.

The cuticular spines on the dorsum (Plate V, fig. 31 SP) are fewer and present only on the seventh to the tenth abdominal segments. The bands on the venter have the same arrangement as in the second stage. There are also on the two last caudal segments compound spines having several branches (Plate V, fig. 31 CSP) scattered over the dorsal surface.

The head has one pair of sensory setae (Plate V, fig. 31 SS) on the dorsal surface. There are also three pairs of sensory setae on both dorsal and ventral surfaces of the body segments as described in the second instar, with the exception of the mesothoracic segment which bears only two pairs.

The internal systems are the same as in the previous instars, but are much more conspicuous in this stage.

The Fourth Instar Larva

The fourth instar larva is 7.2 mm. long and 2 mm. wide. It is a broad, flat larva, much wider anteriorly than posteriorly. The last caudal segment

is shorter than the others (Plate VI, fig. 34). The mandibles (Plate VI, fig. 33) closely resemble those of the third instar with but little differences in the length of the loop of the base and in being narrower in the tip.

The head (Plate VI, fig. 32) is bigger and wider than in the third instar; the parts of the head are more conspicuous and deeper in color and structure; there are several sensory pits and setae distributed regularly on the ventral surface as shown in the diagram. The respiratory system resembles that in the third instar. There are nine pairs of open spiracles (Plate VI, fig. 35) quite conspicuous along the dorso-lateral edge of the body. The spiracles differ widely in their shape from those on the previous instars; they are shorter, more compact, more heavily chitinized, and the opening is larger. The tracheal branches (Plate VI, fig. 35) are much larger and more ramified. The cuticular spines are situated as in the third instar, but there are none in the dorsal and ventral surfaces of the first five body segments. They are present on both surfaces from the third abdominal to the last caudal. Their arrangement is similar to those in the third, but they are fewer in number. The sensory setae are similar in their arrangement to the third.

The Fifth Instar Larva

The fifth instar or the last larval stage measures about 12.0 mm. in length and 2.4 mm. in width. It is slender, tapering towards the cephalic and caudal ends thus resembling somewhat in form to the first instar. The median segments are wide and stout. The head (Plate VI, fig. 36) is narrower and smaller than the first segment, the three thoracic (Plate VI, fig. 36) segments are narrower than the rest of the body and the last three caudal segments are also smaller and narrower. Thus the body is visibly divided into three regions. The last segment (Plate VI, fig. 38) bears an invagination, similar to the first instar, which later forms the anal opening. The mandible (Plate VI, fig. 37) is larger and wider than in the fourth stage and is different in the shape of the base from any of the preceding forms. In this stage the cuticular spines disappear. Sensory setae are numerous and they run in rows along length of the body.

The head presents distinct characters, the hypopharyngeal bracon and the tentorial arms and bridge are strongly developed. The antennae are small fleshy protuberances located latero-ventrally at the apex of the head. The tracheal system and the shape of the spiracles are almost the same as in the previous stage.

The Pupal Stage

The full-grown larva contains a large quantity of the fat body visible beneath the skin. When the larva is fully mature, and just before it enters

into the pupal stage, it voids white lightly yellowish liquid substance known as the meconia. The pupa is transparent at first but as development proceeds, pigmentation appears and increases in intensity until it changes into jet black which is the color of the adult.

The adult *Brachymeria* emerges from the pupa of the host by eating out an irregular hole (Plate 1, figs 5 and 6) in the skin. The head first appears and finally after a short time, adult is seen gracefully walking on the body of the victim.

Conclusion

This species as well as its allied ones are extremely important as natural agents of control on some of our most important crop pests and seem to survive very well under the mild climate of this country. It only remains to be known how and where the species pass our rigor summer months and whether or not they possess several other hosts.

PLATE I

Explanation of Plate I.

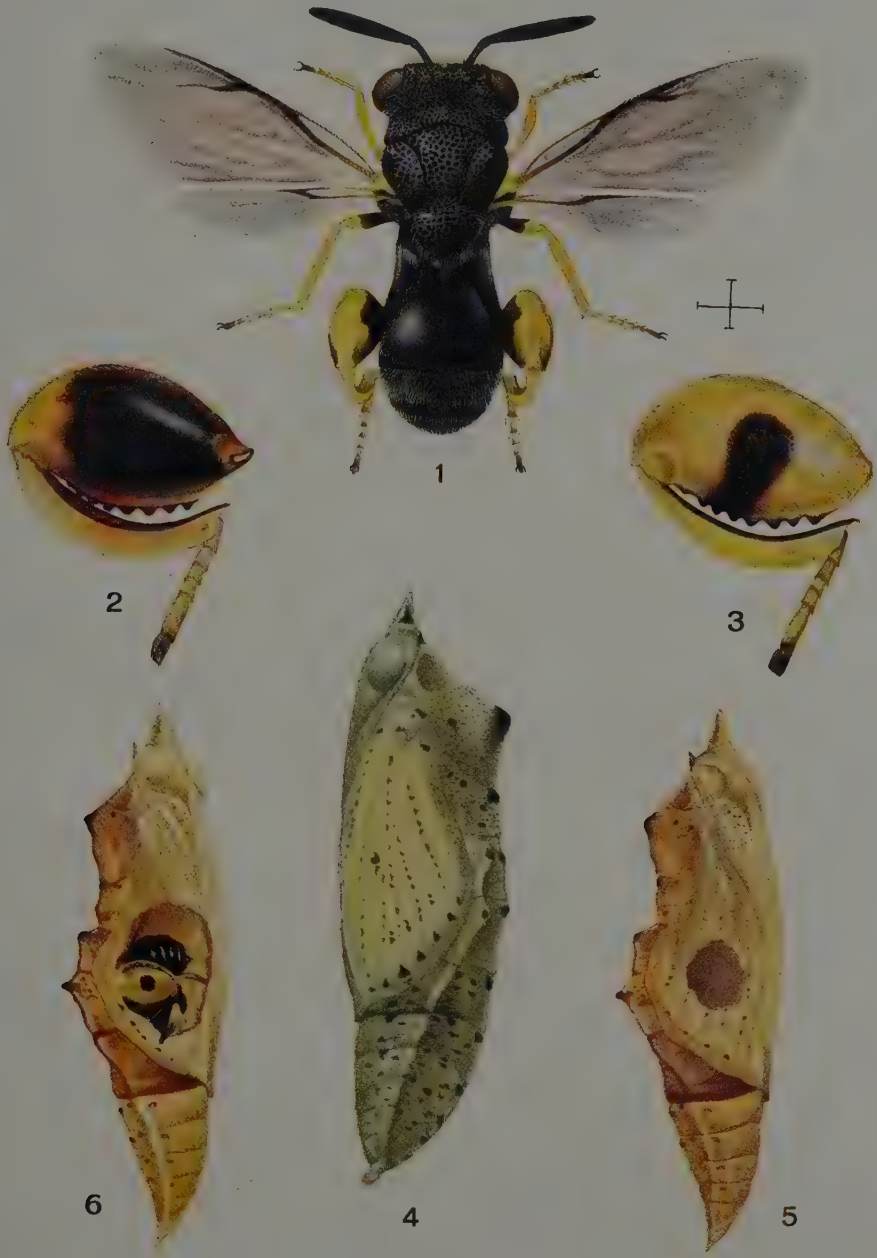
Fig. 1. — *Brachymeria femorata* Panz., adult male (sex apparently indistinguishable).

Figs 2 and 3. — Hind legs of *Brachymeria femorata* Panz. showing markings on both surfaces of the femur.

Fig. 4. — Unparasitized pupa of the cabbage worm, *Pieris rapae* L.

Figs 5 and 6. — Parasitized pupae of *Pieris rapae* L. showing respectively emergence hole and *Brachymeria femorata* Panz. ready to emerge.

Dr. M. Kamal Plate I



Brachymeria femorata Panz. and *Pieris rapae* L.

PLATES II-VI

Explanation of Plate II.

Brachymeria femorata Panz.

Fig. 7. — Egg (magnified).

Fig. 8. — First instar larva (dorsal aspect).

Fig. 9. — Lateral view of the head of same showing : *a*. antenna and *b*. epistoma.

Fig. 10. — Ventral aspect of caudal segments showing bifurcation of the last.

Fig. 11. — Mandible of first instar larva.

Fig. 12. — Mandible tip of first instar larva.

Fig. 13. — Ventral view of first instar larva head showing : *bc*. buccal cavity ; *ep*. epistoma ; *hy*. hypostoma ; *hyb*. hypopharyngeal bracon ; *m*. mandible ; *lea*. lateral epicraneal angle ; *pl*. pleurostoma ; *sp*. sensory pits ; *ss*. sensory setae ; *ttb*. transverse tentorial bar.

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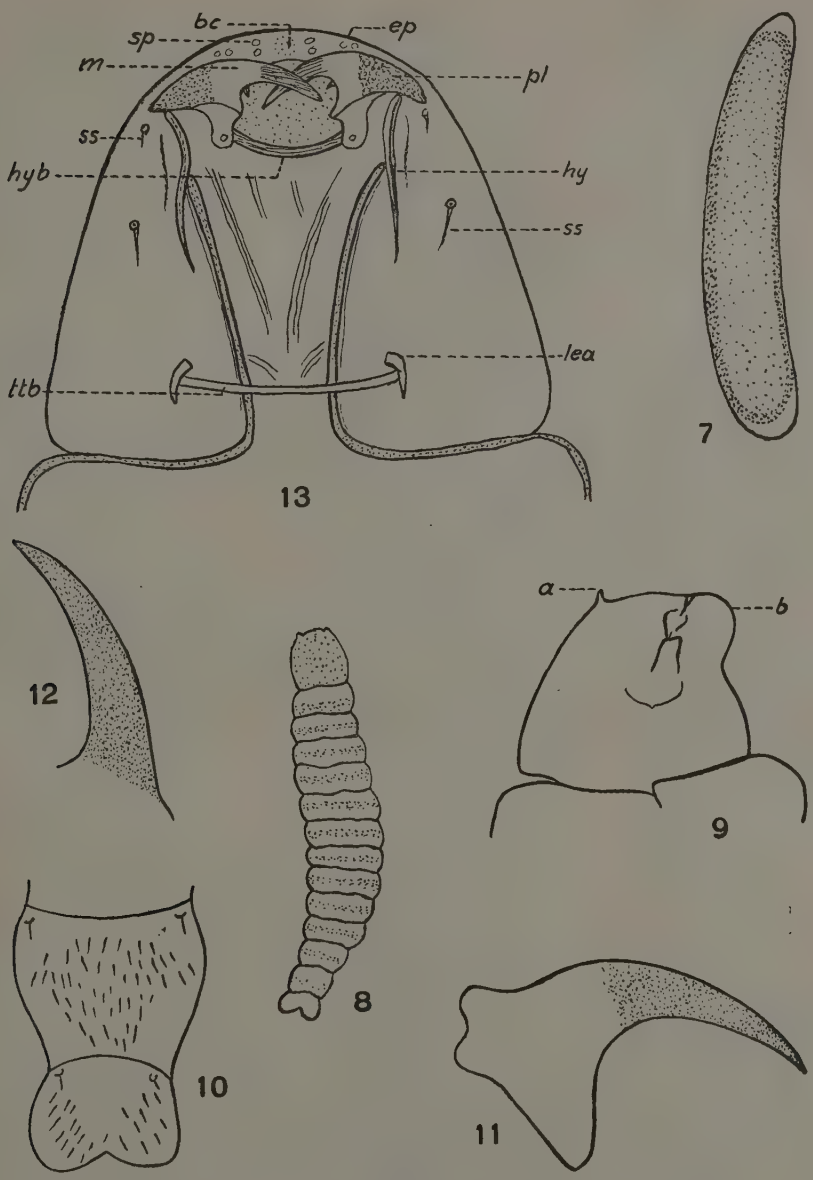
Plate II



Brachymeria femorata Panz. : egg and first instar larva.

Explanation of Plate III.

Brachymeria femorata Panz.

Fig. 14. — Diagram of first larval instar (dorsal view) showing arrangement of spines and sensory setae.

Fig. 15. — Diagram of first larval instar (ventral view) showing arrangement of spines and sensory setae.

Fig. 16. — Body spines of first instar larva.

Fig. 17. — First instar larva (lateral view) showing spiraculatory system.

Fig. 18. — Spiracle of first instar larva.

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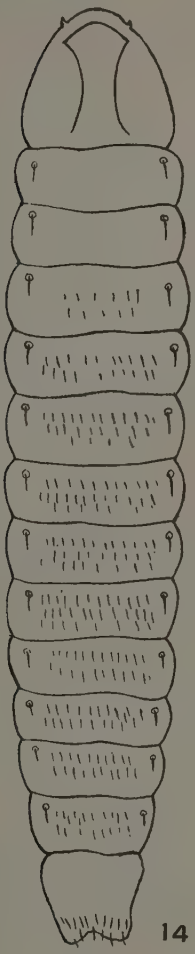
Plate III



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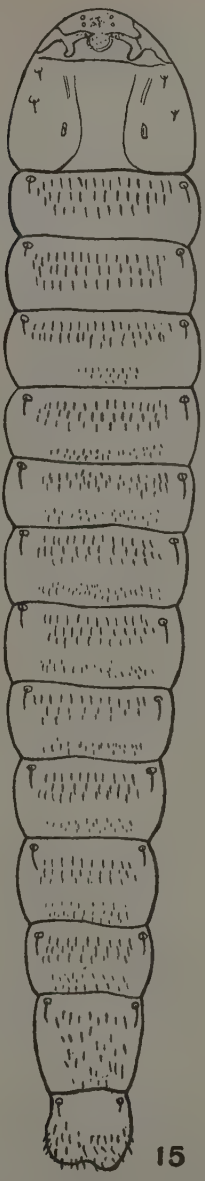

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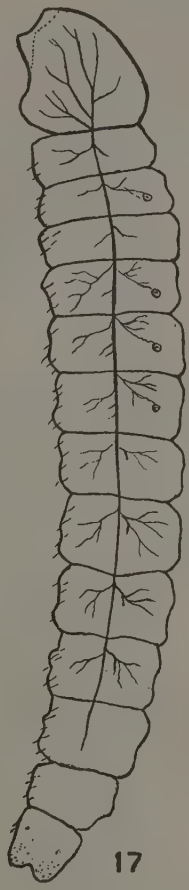

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Brachymeria femorata Panz.: first instar larva.

Explanation of Plate IV.

Brachymeria femorata Panz.

Fig. 19. — Drosal view of second instar larva showing tracheal system.

Fig. 20. — Mandible of second instar larva.

Fig. 21. — Mandible tip of second instar larva.

Fig. 22. — Ventral view of the arrangement of spines on the last caudal segments.

Fig. 23. — Spiracle of second instar larva.

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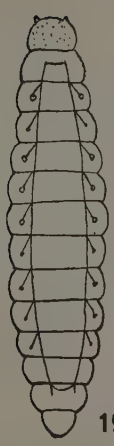
Plate IV



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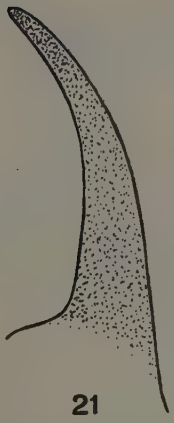

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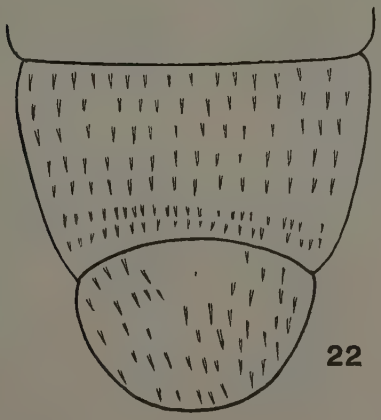

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Brachymeria femorata Panz.: second instar larva.

Explanation of Plate V.

Brachymeria femorata Panz.

Fig. 24. — Dorsal view of third instar larva.

Fig. 25. — Ventral view of head of third instar larva.

Fig. 26. — Mandible of third instar larva.

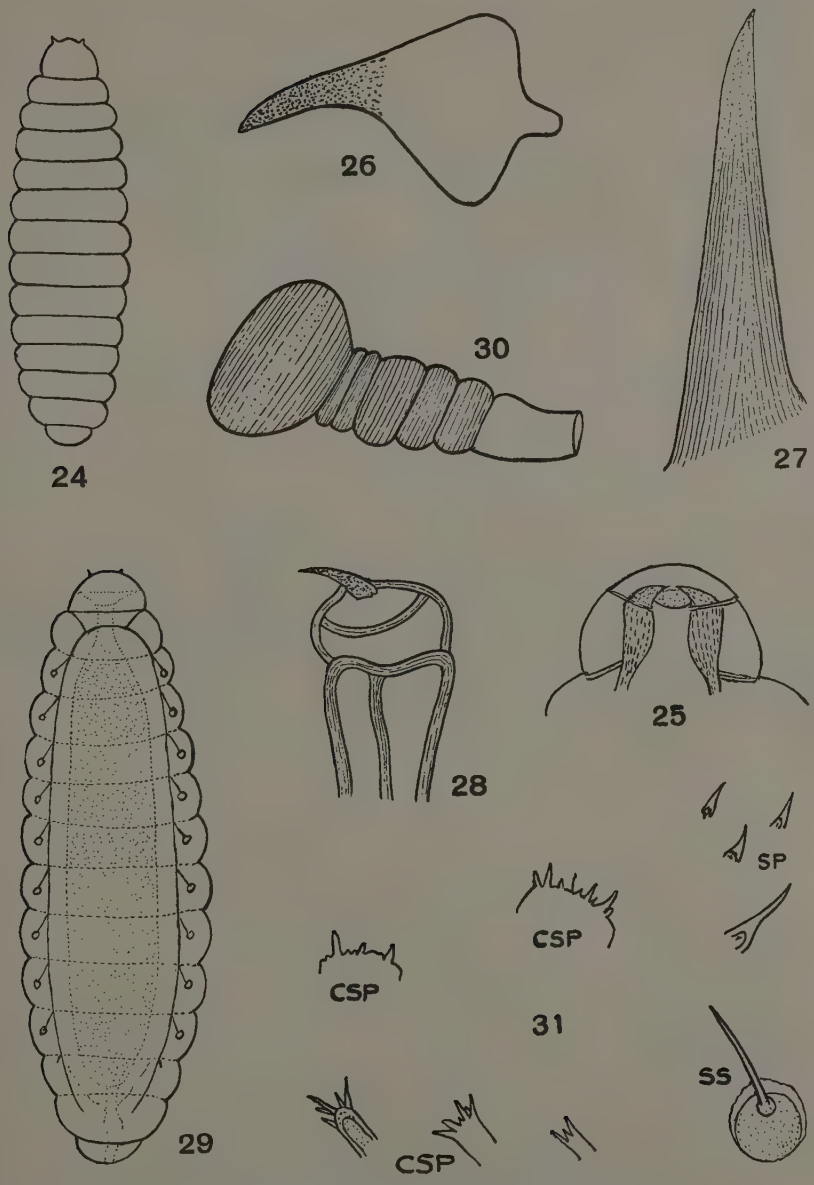
Fig. 27. — Mandible tip of third instar larva.

Fig. 28. — Mandible attachment and chitinized plates of third instar larva.

Fig. 29. — Diagram of third instar larva showing tracheal and digestive systems.

Fig. 30. — Spiracle of third instar larva.

Fig. 31. — Compound cuticular spines (CSP), ordinary body spines (SP), and sensory setae (SS) of third instar larva.



Brachymeria femorata Panz.: third instar larva.

Explanation of Plate VI.

Brachymeria femorata Panz.

Fig. 32. — Ventral view of head and first thoracic segment of fourth instar larva.

Fig. 33. — Mandible of fourth instar larva.

Fig. 34. — Last caudal segments of fourth instar larva.

Fig. 35. — Spiracle of fourth instar larva.

Fig. 36. — Lateral view of head and thorax of the fifth or last larval instar.

Fig. 37. — Mandible of last larval instar.

Fig. 38. — Caudal segments of fifth or last larval stage.

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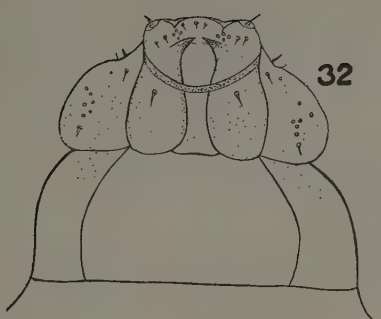
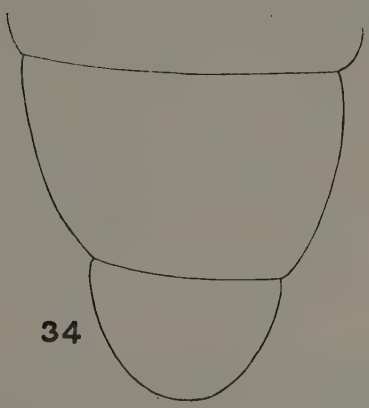
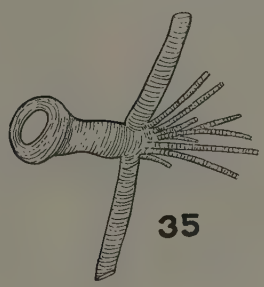
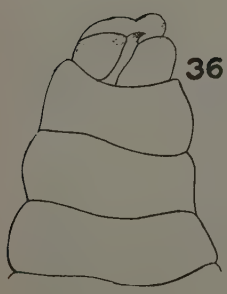
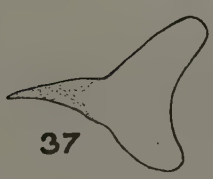
Plate VI

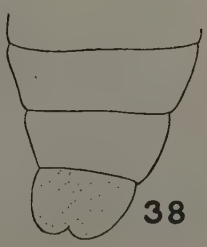












Brachymeria femorata Panz.: fourth and fifth larval instars.

Séance du 22 Février 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Quelques nouvelles fourmis d'Egypte

(avec 8 Figures)

par le Dr. F. Santschi

Monsieur A. Alfieri, sécrétaire général de la Société Royale Entomologique d'Egypte, avait confié en 1926, à Monsieur W.C. Crawley, de Londres, l'étude d'un riche matériel myrmécologique provenant d'Egypte. Ces fourmis étaient réparties en 686 tubes et deux grandes boîtes. Les tubes furent examinés et déterminés par l'entomologiste anglais et le résultat publié par Monsieur A. Alfieri, dans le *Bulletin de la Société Royale Entomologique d'Egypte*, 1931, pp. 42-48, avec titre : « *Contribution à l'étude de la faune myrmécologique d'Egypte* ». Cependant, Monsieur Crawley, dont la vue s'affaiblissait, dût renoncer à étudier les deux boîtes, lesquelles, sur l'avis de Monsieur Alfieri, me furent envoyées. Malheureusement, les insectes piqués furent fort maltraités durant les deux voyages qu'ils eurent à effectuer du Caire à Londres et de là à Kairouan. Les gros abdomens des *Dorylus* mâles, facilement séparés du thorax, vinrent heurter les petits insectes et les brisèrent. Les boîtes furent aussi ouvertes en cours de route, car beaucoup d'épingles étaient dépiquées et une partie des débris manquaient, me rendant impossible la reconstitution de fourmis rares ou inédites dont une partie seule restait attachée à l'épingle. Ces conditions n'étaient pas encourageantes pour entreprendre cette étude. De plus, comme à première vue ce qui restait paraissait aussi commun que les espèces déterminées par Monsieur Crawley et dont la liste à été signalée plus haut, je m'occupais d'autres travaux, oubliant ces boîtes pendant plusieurs années. Monsieur Alfieri, m'ayant rafraîchi la mémoire, je me mis au travail, avec un intérêt qui grandit à mesure que je m'apercevais que la faune myrmécologique égyptienne était bien plus riche qu'on ne le pouvait supposer d'après les 686 tubes étudiés par Crawley, et mérite, je pense, une révision. Sur ces entrefaites, je reçus une très intéressante brochure de Monsieur B. Finzi, « *Risultati*

scientifici della spedizione di S.A.S. il Principe Alessandro della Torre e Tasso nell'Egitto e peninsola del Sinai. — XI. Formiche », paru dans ce Bulletin, 1936, pp. 155-210. Dans ce travail, l'auteur fait une mise au point des espèces égyptiennes connues jusqu'ici et y en ajoute des nouvelles. Cela me dispense de faire moi-même ici une telle monographie. La liste de Finzi, cependant, me paraît devoir être bien augmentée dans la suite maintenant que l'attention des chercheurs est stimulée par la certitude d'une faune myrmécologique égyptienne des plus intéressantes.

Voici la liste et la description des espèces communiquées par Monsieur Alfieri et que j'ai étudiées.

Sous-famille des DORYLINAE Leach.

Dorylus (*Typhlopone*) *fulvus* Westw. var. *ruficeps* Santschi (Fig. 1 A).

Mariout : 25.VII.14, ♂ "on light" ; 10.III.14, ♀♀. — Marsa-Matruh, 1916, ♂. — Salloum, 5.VIII.17, ♂, exemplaire à tête étroite (4,5 mm.). — Wadi Digla, 5.VIII.23, ♂.

Dans son récent travail cité plus haut, Monsieur B. Finzi rapporte à la var. *punicus* Sant. tous les *Dorylus* égyptiens examinés par lui, se basant pour cela sur un travail récent de Monsieur Menozzi « *Formiche della Palestina* » (1933, *Mem. Soc. Ent. Ital.*, pp. 49-113), lequel crût devoir mettre en synonymie la var. *ruficeps* Sant. du Liban avec la var. *punicus* Sant. de l'Afrique mineure, cela du fait que la couleur de la tête des 600 mâles récoltés par Bodenheimer varient beaucoup. Il ne dit pas si tous ces ♂♂ ont été pris dans le même nid, ce qui laisse supposer qu'ils peuvent

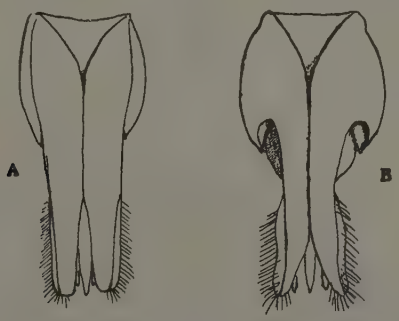


Fig. 1. — *Dorylus (Typhlopone) fulvus* West. var. *ruficeps* Santchi (A) et var. *punicus* Santschi (B) : armature génitale mâle vue de dessus.

appartenir à des variétés différentes. Cette question m'a incité à examiner l'armure génitale de mes types de ces deux variétés. Il en résulta des différences assez notables pour qu'elles soient maintenues. En effet, chez *ruficeps* (Fig.1 A) les stipes, vus de dessus, sont plus droits et leur base plus étroite,

ne laissent pas voir, comme chez *punicus* (Fig. 1B), la base des volsella apparaître en dehors.

Les exemplaires égyptiens se rapportent à la var. *ruficeps* par la forme de l'armure génitale, bien que chez certains individus ils fassent un peu transition à *punicus* et malgré la coloration un peu variable de la tête. Quant aux ouvrières du Mariout, que j'ai sous les yeux, elles se rapprochent de la var. *punicus* par la tête allongée mais qui est encore distinctement plus étroite et plus foncée. C'est peut-être l'ouvrière de la var. *ruficeps*. Sa capture dans le nid avec les mâles tranchera la question.

Aenictus fuscovarius Gerst. st. *sagittarius* nov. (Fig. 2).

♂. — Longueur 6-6,5 mm. environ. — Jaune-miel clair ainsi que les appendices, les nervures et les taches alaires. Tête d'un jaune plus rougeâtre avec une bande noirâtre ou brunâtre sur le vertex et unissant les yeux et les ocelles. Lisse et luisant avec une très fine ponctuation pilifère. Pubescense assez dense sur le corps, surtout sur le gastre mais ne voilant pas la sculpture. La pubescense du funicule est beaucoup plus courte et plus relevée que celle du corps. Il y a de longs poils fins et courbes sur les scapes, les cuisses et les tibias, plus courts vers la bouche et sous la tête.

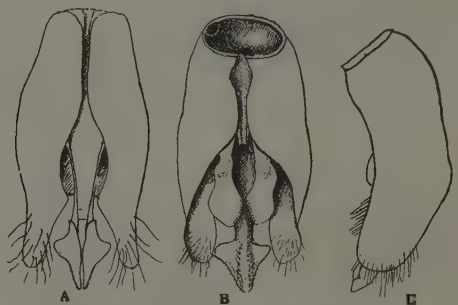


Fig. 2. — *Aenictus fuscovarius* Gerst. st. *sagittarius* nov. : armature génitale mâle, (A) face supérieure, (B) face inférieure, (C) face latérale.

Tête deux et demi fois plus large, avec ses gros yeux, que haute du bord antérieur de l'épistome au bord postérieur entre les ocelles. Vue de la face occipitale, la tête est très nettement concave devant grâce aux yeux prohéminents en avant. Derrière ceux-ci, les bords de la tête sont rectilignes et convergent jusqu'au bord cervical lequel est droit, transversal. Les ocelles sont distants d'un peu plus de la moitié de leur diamètre. Les mandibules sont presque aussi larges à leur base que l'épaisseur des yeux, arquées et longues comme environ la largeur de l'épistome. Scape comprimé, long comme trois fois sa plus grande largeur. Deuxième article du funicule conique, une

fois et un tiers environ plus long que le premier, le suivant légèrement plus large que long (vu dans sa plus grande largeur, c'est-à-dire perpendiculairement à la courbe que forme le funicule). Thorax comme chez *fuscovarius* mais un peu moins robuste. Le bord postérieur du scutellum dépasse le métanotum autant que la face basale de l'épinotum. Pétiole deux et un tiers environ aussi large qu'il est long au milieu. La face supérieure transversalement concave. Les bords latéraux minces et relevés. Cuisses progressivement renflées de la base à leur bout. L'armure génitale diffère de celle de *fuscovarius* et de la var. *magrettii* Em. (voir Emery : *Ann. Mus. Civ. Genova*, vol. 32, 1892, figs p. 110), par les sagitta terminées en pointe de flèche plus large, plus courte et dans l'axe des stipes. Ceux-ci sont plus arrondis au bout. Les volcelles ont non seulement le bord, mais aussi leur face intérieure garnis de petits poils recourbés en ?.

Dakhla oasis, 13.VI.1918, 3 ♂♂ (Storey). — Derr, 16.III.17, 1 ♂ (Adair).

Soudan : Sennar, 25-27.II.1914, ♂ (Ebner).

J'ai reçu ce dernier exemplaire sous le nom de *A. Magretti* Em. Il ressemble aux précédents par l'aspect externe. La différence est dans le troisième article du funicule plus court, mais surtout par les génitalia comme indiqué plus haut.

Sous-famille MYRMICINAE Lepel.

Messor semirufus And. var. *ebeninus* Forel.

Wadi Tamanid, 22.III.27, ☿.

Messor aegyptiacus Sm.

Wasta, 8.VI.1916. — Nawa, 16.XI.13, ☿. — Giza, 1.III.13, ☿. — Alexandrie, 10.III.14, 1 ☿.

Messor aegyptiacus Sm. var. *foreli* Santschi.

Bir Sheftun (arabian desert north Nag-Hamadi), 2 ☿☿, 3.III.1926.

Messor aegyptiacus Sm. var. *fellah* Santschi.

Wasta, 8.VI.16, ☿. — Meadi, 17.II.14, 5 ☿☿ incomplètes et incertaines sans les ♂♂. — Abu Rowash, 26.VIII.25, 2 ☿☿.

J'ai décrit cette variété sur deux exemplaires, une grande et une petite ☿☿ collées sur la même brochette et reçues ainsi de Monsieur Karawaiew. Or, je m'aperçois maintenant que la petite ☿ toute noire correspond à la var. *foreli*, tandis que la grande représente bien le type de la var. *fellah*. Les petits exemplaires d'Abu Rowash appartient à la var. *fellah*, ayant seulement le quart postérieur de la tête et le devant du thorax rougeâtres, le reste du corps et les membres noirs. L'épinotum est faiblement denté comme chez *aegyptiacus* type.

Messor rufotestaceus Forst.

Wadi Hof, 8.IV.14, ♀.

Messor arenarius Fab.

Cette espèce a un assez vaste habitat comprenant l'Afrique du nord, la moitié du Sahara et la Syrie. Elle paraît plus rare au Maroc qu'en Algérie et en Tunisie. L'Egypte au contraire, où se trouvent des variétés et une espèce très voisine, me paraît être le berceau du *M. arenarius* Fab.. Peut-être y est-elle venue par la vallée du Nil. Cette belle espèce rappelle les grands *Messor* africains tels que *cephalotes* Em. et *regalis* Em. Monsieur Menozzi a décrit sous le nom de *ratus* une variété du *M. arenarius* provenant de Palestine et atteignant 17,8 mm. Elle a toutes les stries de la tête parallèles et droites près du bord postérieur. Sans indication de couleur et de forme, on peut supposer qu'elle se rapporte pour le reste entièrement au type.

Elle vit dans le sable restant humide à peu de profondeur. Elle transporte le sable sous forme de boulettes, et cette façon de faire ne nécessite pas un psammophore aussi développé que chez le *Messor* strictement arenicole. En Tunisie elle vit le long des plages sablonneuses de Monastir, Sousse, Hammamet et va chercher sa nourriture jusqu'à l'extrême bord mouillé par les vagues de la mer.

Malgré ce vaste habitat, l'espèce a toujours été considérée comme très constante. J'ai été le premier à en distinguer la var. *thebaicus* (1912), sur des individus provenant d'Egypte. Le matériel communiqué par Monsieur Alfieri me fait constater une variabilité morphologique plus importante et méritant d'être retenue. Mais, pour commencer, if faut définir celle qui doit être considérée comme typique. Fabricius la désigne en ces quelques mots : « *Formica arenaria : Thorace postice impresso, bispinoso, atra, plantis piceis* ». A cela, Latreille (1802) ajoute : « *Elle est grande, la tête est forte, ovale, lisse, très noire. Le corselet est comprimé, noir, avec une impression et deux fortes épines à son extrémité postérieure. Le pédicule est de deux nœuds. L'abdomen est presque globuleux, pubescent. Les pattes sont noires avec les tarses seuls d'un brun foncé. Elle a été rapportée des côtes de Barbarie par le célèbre botaniste Vahl. Elle s'y trouve sur le sable mouvant* ».

Latreille écrit que la tête est lisse, c'est certainement un *lapsus calami*, car il n'y a que le *Messor capitatus*, d'ailleurs bien décrit par Latreille lui-même, qui parmi les *Messor* nord-africains, pourrait être confondu dans cette diagnose. Celui-ci n'a pas la tête ovale, le thorax n'a pas de fortes épines mais est à peine denté et ne vit pas dans le sable. C'est donc la forme la plus commune de Tunisie et d'Algérie que je considère comme typique.

L'ouvrière est polymorphe, les grands individus de 15 mm. sont noirs, avec la tête plus longue que large, à bord postérieur nettement échancré. Les

exemplaires moyens, de 8 à 12 mm., ont la tête moins allongée, à bord postérieur droit ou à peine concave ; ils sont d'un noir passant plus ou moins au brun-rouge obscur. Les petites ouvrières, de 5 à 8 mm., sont d'un brun moyen, plus clair chez les plus petits individus ; la tête est, chez ces derniers, aussi large que longue, convexe derrière, le dessus lisse et luisant, les côtés et le devant finement réticulés-ponctués sans rides. Elle sort rarement du nid, je l'ai vue quelques fois apparaître à son orifice les jours suivant la pluie et de ce fait si rare. La différence des grandes ouvrières est si accusée que Forel en avait fait une espèce distincte (st. *bugnioni*). En outre, les dents épinotales bien développées et fortes chez les grandes ☿ ☿ s'atténuent de plus en plus pour n'être que de petits denticules chez les ☿ ☿ minima. Les caractères sur lesquels se base la différenciation des variétés sont ceux de la sculpture, couleur et forme de la tête. Je donne ici les caractères pour la forme type que soulignent les figures ci-incluses (fig. 3).

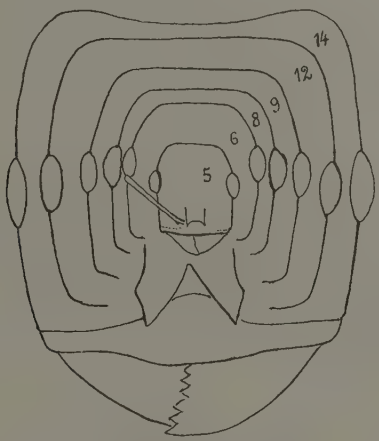


Fig. 3. — *Messor arenarius* Fab. : tête des ouvrières de 5, 6, 8, 9, 12 et 14 mm. (série d'exemplaires de Ghardaia).

☿ (noire). — Souvent la tête, et parfois tout ou partie antérieure du thorax, légèrement teinté de rougeâtre sombre. Scapes, hanches, cuisses, tibias, pédoncule et gastre noirs. Mandibules, funicules et métatarses brun-rouge plus ou moins foncé. Petits tarses et articulations des tibias roussâtres. Pilosité dressée, jaune, longue comme environ la largeur moyenne des tibias, plus abondante sur le gastre, plus rare sur la tête ; elle est plus fine, plus courte et un peu oblique sur les membres. Psammophore bien développé quoique moins que chez *aegyptiacus* Em. La sculpture fondamentale consiste, pour la tête, le thorax et le pédoncule, en une très fine réticulation ponctuée, dense,

sur laquelle s'ajoutent des rides plus ou moins fortes et disposées comme suit : plus fines et plus denses sur la tête où elles sont longitudinales depuis le bord antérieur de l'épistome jusqu'au niveau des yeux, de là les médianes divergent vers les angles postérieurs de façon à ce qu'elles soient transversales sur le vertex et le bord postérieur de la tête, mais elles s'effacent près du bord cervical et le dessous de la tête qui sont lisses et luisants. Les plus rapprochées des yeux contournent ces organes pour s'anastomoser avec les rides latérales de la tête. Entre les yeux et le front elles sont plus irrégulières et interrompues, quoique plus fortes, laissant voir la sculpture ponctuée du fond. Celle-ci, au contraire, s'efface dans les inter-rides du front et de l'épistome. Les rides du thorax sont plus grossières que celles de la tête. Transversales sur le dos et la face déclive de l'épinotum. Les pronotales parallèles à son bord latéral antérieur et sur la mésopleure plus ou moins parallèles à son bord inférieur, plus faibles et irrégulières que celles des côtés du pronotum, laissant souvent prédominer la sculpture fondamentale. Sur les côtés de l'épinotum elles sont verticales en avant du stomate et horizontales en dessous, se dirigeant avec celles du métasternum vers l'articulation du pétiole. Dessus du nœud irrégulièrement ridé en long. Gastre réticulé ponctué, mat vers sa base, réticulé-chagriné et assez luisant ailleurs.

☿ (media). — Les rides s'effacent peu à peu dans le lit du scape, les tempes, le vertex et les méso-métapleures.

☿ (minor). — Il ne reste plus que quelques rides irrégulières sur l'épinotum. La réticulation fondamentale s'efface à son tour sur le front et le vertex, ne laissant persister que la grosse ponctuation pilifère. Pour la forme de la tête dans la série des grandeurs voir la figure.

Tunisie : Kairouan. Dratamar, Cherrichera, Monastir, Sousse, Hammamat, Carthage, Tozeur (Santchi); Djerba (A. Weisss).

Algérie : Ain-Sefra (Boïtel & Seurat); Ghardaia (Mlle R. Tourniol).

Messor arenarius Fab. st. *alfierii* nov. (Fig. 4).

☿. — Diffère du type par la sculpture des côtés du thorax plus accusée. Chez les grandes ☿ ☿, les rides de la mesopleure sont plutôt horizontales, comme pour la métapleure. La tête est plus étroite et plus échancrée derrière chez les ouvrières major et média-major. Elle est d'un rouge-sombre, avec les joues, une large bande, franchement noires, comprises entre les arêtes frontales et atteignant le bord postérieur de la tête. Base des mandibules rouge-brunâtre. Les épines de l'épinotum moins développées que chez le type. Long : ad 15 mm.

Meadi, 18.XII.12, ☿. — Le Caire, ☿ (A. Borcard). — Mariout, 13.XI.13, ☿ (Storey). — Alexandrie, 11.XI.13, ☿.

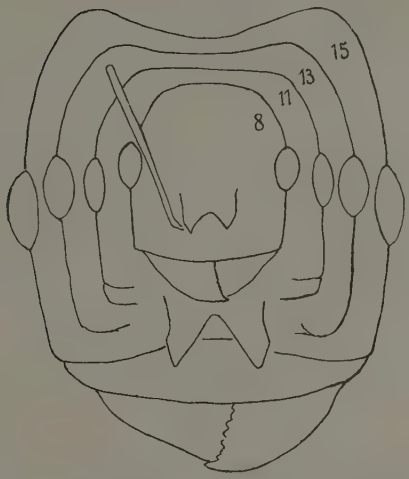


Fig. 4. — *Messor arenarius* Fab. st. *alfierii* nov. : tête des ouvrières de 8, 11, 13 et 15 mm. (celle de 8 mm. est du Mariout et les autres sont de Meadi).

Messor arenarius Fab. var. *diabolus* nov. (Fig. 5).

☿ (major). — Noire. Mandibules noir-brunâtre. Moitié du funicule et tarses roux-brunâtre. Sculpture intermédiaire entre le type et la st. *alfierii*, dont *diabolus* diffère par l'échancrure postérieure de la tête, plus profonde et transformant en cônes arrondis les angles postérieurs. Ceux-ci sont soulignés par une impression plus ou moins accusée à leur base, transversale. Taille du type.

El Arich (Sinai), 28.VIII.17 (Graves), une seule ☿.

* *Messor arenarius* Fab. st. *thebaicus* Santschi.

(1912, *Ann. Soc. Ent. Belg.*, LVI, p. 164).

Cette forme se distingue par sa couleur rouge-grenat des tête, thorax et pédoncule. Cuisses et tibias brun-rougeâtre. Scape et gastre brun-noirâtre. La tête est moins large que chez *arenarius* type, mais plus large que chez *alfierii* et *diabolus*. Le bord postérieur un peu plus échancré que chez le type. Les rides s'effacent plus ou moins complètement entre les yeux, le front et le vertex, de façon à ce qu'il ne reste que la sculpture dense, réticulée, ponctuée du fond. L'épinotum est plus faiblement denté. Je ne connais pas la petite ☿. La ♀ a la tête rouge, le thorax nettement plus élevé et la face basale de l'épinotum plus verticale que chez le type.

Alexandrie, ☿, 10.III.14. — Salloum, 3 ☿☿, 24.II.14. — Maamura, ☿, 15.II.16.

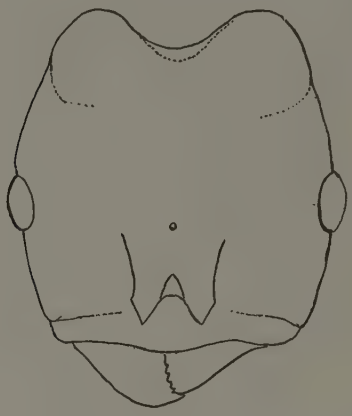


Fig. 5. — *Messor arenarius* Fab. var. *diabolus* nov. : tête d'une ouvrière longue de 13 mm. et provenant de El Arish (Sinaï).

Messor niloticus nov. spec. (Fig. 6).

☿ (media et major). — Longueur 12 à 16 mm. — Rouge. Bord de l'épistome et des arêtes frontales, scape, parfois le bord inférieur des meso- et metasternum, tout ou partie du gastre, d'un brun-noirâtre ou noir. Base

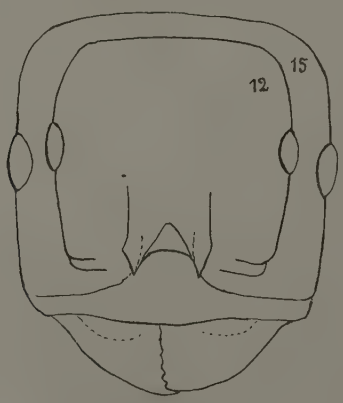


Fig. 6. — *Messor niloticus* nov. spec. : tête des ouvrières de 12 et 15 mm.

du gastre parfois brun-roussâtre. Funicule et pattes roux-brunâtre clair ; les hanches plutôt rouges. Tête, thorax et pédoncule mats, densément réticulés-ponctués, en outre le bord antérieur de la tête est ridé-strié en long. De ces

rides s'en détache une paire rectiligne passant entre les arêtes frontales et s'effaçant vers le vertex. Un autre faisceau, aussi large que le précédent, oblique vers les arêtes frontales, remplit les fosses antennaires, pour s'arrêter à la hauteur des yeux. Quelques rides divergent dès le départ du précédent faisceau pour contourner le bord antérieur des yeux. Le dessous de la tête est entièrement réticulé-ponctué et sub-mat (lisse et luisant chez *arenarius*). De grosses rides transversales sur le dos du thorax, disposées comme chez *arenarius* mais avec la sculpture fondamentale plus apparente. Les rides manquent parfois sur la mesopleure. Nœud du pédoncule avec quelques rides irrégulières sur la face postérieure et sur le haut des côtés. Gastre finement réticulé, sub-mat. Pilosité comme chez *arenarius*.

☿ (major). — Tête carrée avec les angles postérieurs arrondis. Yeux un peu plus petits que chez *arenarius*. Bord antérieur de l'épistome transversal, à peine sinué.

Mandibules striées avec quelques points épars et inter-rides lisses et luisants, le bord de 6 à 7 dents plus ou moins mousses ou effacées. Le scape atteint le bord postérieur de la tête. Le premier article du funicule aussi long ou à peine plus long que le suivant (comme chez *arenarius* dont on a, à tort, écrit qu'il est plus court que le suivant). Le thorax diffère de *arenarius* par la déclivité postérieure du mesonotum un peu moins convexe, et celle de l'épinotum bien moins abrupte (angle de 120° à 130° chez *niloticus*, de 105° à 110° chez *arenarius*). La face basale légèrement plus convexe sur le profil. Dents plus petites ou denticulées. Le reste comme chez cette espèce.

☿ (media) de 11 mm. — Diffère de la grande ☿ par la tête un peu plus allongée. Le scape la dépasse derrière de deux fois son épaisseur. Face déclive de l'épinotum encore un peu moins abrupte. Les rides moins accusées. Les ☿☿ minor et media-minor sont encore inconnues.

Intéressante espèce tenant entre *arenarius* F., *thebaicus* et *cephalotes* Em., mais ressemble beaucoup à celle-ci par sa couleur et sa tête carrée. Chez *cephalotes* les stries prédominent, le fond de la sculpture étant lisse. Les ☿☿ ont la tête plus grande, l'epinotum plus allongé, plus rectiligne dessus et plus abrupt derrière. Voisine aussi du *M. oertzeni* Forel des Balkans.

Mariout, ☿ (Type), 10.III.1914.

* *Aphaenogaster (Attomyrma) splendida* Rog.

Le Caire, ☿, 12.VII.16.

Pheidole teneriffana Forel.

Ghezireh, ☿, 23.VIII.23. — Giza, 4 ☿☿, 30.IX.1919 et 4 ☿☿ 15.X.27.

Pheidole sinaitica Mayr.

Meadi, ☿ et ♀, 29.VII.14. — Mariout, 12.XI.13, ☿.

Crematogaster (*Acrocoelia*) *auberti* Em. st. *antaris* For. var. *nigripes* Em.

Ces exemplaires sont moins obscurs que ne le décrit Emery pour *nigripes*. Ils sont plutôt brun-rougeâtre, les appendices à peine plus foncés. La moitié postérieure du gastre brun-foncé. La sculpture intermédiaire entre *antaris* et *laevithorax* For.. La face basale de l'épinotum lisse ou avec quelques rides, mais luisante. Le scape est un peu plus long que chez *antaris*. Le ♂, que je soupçonne se rapporter à cette forme, a l'epinotum plus allongé que chez *inermis* et *antaris*, et même un peu plus allongé mais moins convexe que chez *auberti* type.

6th Tower (Suez Road), 8.II.25 (Alfieri), ☿. — Dekheila, 20.II.17, ☿.

Crematogaster (*Acrocoelia*) *jehovae* Forel.

Alfia, 18.X.14, ♀ (variété, mais exemplaire incomplet).

Crematogaster (*Acrocoelia*) *inermis* Mayr (Fig. 7).

Hammam (Mariout), 28.X.16, ☿. — Nag-Hamadi, 17.VIII.17 (Storey), ♂.

Variété noire, un seul exemplaire, incomplet, le thorax aussi sculpté que chez *inermis* type.

♂ (non décrit). — Longueur 3 mm. — Noirâtre, appendices jaune-brunâtre. Luisant. Front et vertex lisses ou très finement chagrinés, assez luisant. Quelques gros points allongés sur les côtés du mesonotum. Meso-

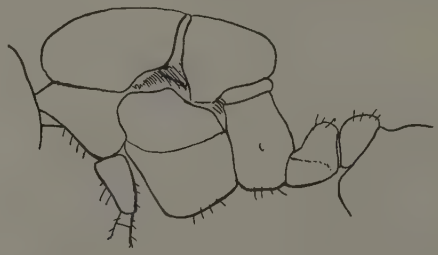


Fig. 7. — *Crematogaster (Acrocoelia) inermis* Mayr: thorax et pédoncule du mâle, vus de profil.

et metasternum réticulés, mats, tout le reste lisse et luisant. Aile hyaline à nervures pâles. Diffère de la var. *lucida* par son thorax un peu plus court et surtout par l'epinotum sans face basale, descendant presque droit et verticalement, débordé dessus par le scutellum.

* *Crematogaster* (*Acrocoelia*) *inermis* Mayr var. *lucida* Forel.

Wadi Hof, ☿ et ♂, 28.X.16. — Embaba, on Sunt, ♀, 16.XII.28. — Ras-el-Bar, ♀, VII.16.

Variété noire passant à la var. *aphrodites* Sant. (Voir la description et la figure de la var. *lucida* For. dans « *Contribution à l'étude des Crematogaster paléarctiques* », *Mém. Soc. Vaud. Sc. Nat.*, 1937, pp. 295-317).

Monomorium (*Paraholcomyrmex*) *gracillimum* Sm.

Ghezireh, 23.VIII.23, ☿ « feeding on millet grain in field » (Alfieri). — Giza : 1.I.28, ☿ « on Lebbek » ; 9.X.28, ☿ ; 25.IV.14, ☿. — Meadi : 26.II.13, ♀ ; 23.I.23, ♂. — Wadi Hof, 26.III.16, ☿.

Monomorium (*Xeromyrmex*) *bicolor* Em. var. *nitidiventre* Em.

Ghezireh, 23.VIII.23, ☿ et ♀ « from nest in millet plant » (Alfieri). — Giza : 9.X.28, ☿ ; 2.VIII.28, in light trap.

Monomorium (*Xeromyrmex*) *salomonis* L. st. ?

Meadi, 23.IV.13, ♀ (incomplète).

* *Monomorium* (*Xeromyrmex*) *salomonis* L. st. *arenarium* Santschi var. *fezzanense* Santschi.

Wadi Hof, 3.IV.14, ☿ (exemplaires faisant passage à la var. *zanoni* Em. dont quelques uns, plus clairs, paraissent immatures).

Monomorium (*Monomorium*) *pharaonis* L.

Ghezireh, 23.VIII.23, ☿ (Alfieri).

Leptothorax (*Goniothorax*) *angulatus* Mayr.

Le Caire, ♀, 25.IV.14.

Sous-Famille DOLICHODERINAE Forel.

Tapinoma simrothi Kraus. var. *phoenicum* Em.

El Alag, 15.III.14, ♂. — Mariout, 10.III.14, ☿ et ♂. — Marg, 21.III.13, ♂.

Sous-Famille FORMICIDAE Lepel.

Plagiolepis pallescens Forel var. *isis* nov. (Fig. 8).

☿. — Longueur 1,6 à 1,7 mm. — Variant du jaune-roussâtre au brun-foncé. En général d'un jaune-roussâtre ou un peu brunâtre avec le gastre brun. Dans un tiers des cas la tête et le thorax sont rembrunis, sauf l'epistome et les appendices toujours jaunâtres. Luisant, le gastre moins luisant et à reflets graisseux. Pubescense fine et clairsemée. Tête un peu moins large que chez *ancyrensis* Santschi, avec les côtés plus parallèles. Vus de face, les yeux dépassent légèrement les côtés de la tête (un peu moins convexes et dépassant à peine chez *ancyrensis*). Sur le profil de la face de flexion, le deuxième article du funicule est plus large que long, le troisième aussi large

qu'épais, les suivants plus allongés. Scape comme chez *ancyrensis*, ou un peu plus mince. Thorax un peu moins long.

♀. — Longueur 3,8 mm. — D'un brun-marron. La tête plus obscure. Appendices jaune-roussâtre avec les dix derniers articles de l'antenne et les

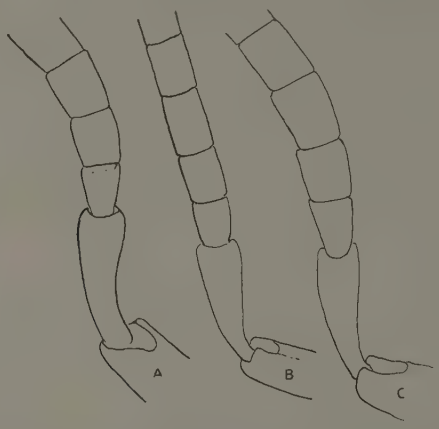


Fig. 8. — Premiers articles du funicule et bout du scape chez la femelle de (A) *Plagiolepis pallescens* Forel var. *atlantis* Santschi, (B) var. *isis* nov., (C) var. *ancyrensis* Santschi.

cuisses légèrement rembrunis (moins roussâtre chez *ancyrensis* et *atlantis* Santschi). Tête mate, densément réticulée-ponctuée, le reste sub-mat ou peu luisant. Tête plus large que longue, rétrécie devant avec les angles postérieurs assez fortement arrondis. Le scape les dépasse de près d'un quart de sa longueur. Yeux peu convexes. Les articles du funicule restent plus allongés ou moins épais que chez *ancyrensis* et *atlantis* (fig.8). Chez *ancyrensis*, les angles postérieurs de la tête sont plus accusés et chez *atlantis*, la tête est aussi longue que large.

Ghezireh, 23.VIII.23, ☿ et ♀ (from nest in millet plant [Alfieri]).

Dans son travail Finzi (1936) a rapporté avec doute à la var. *atlantis* une ☿ de Siwa. Il se peut qu'il s'agisse de cette variété.

Camponotus (*Myrmoturba*) *maculatus* F. st. *aegyptiacus* Em.

Meadi: 25.III.13, ☿; 16.IV.16, ♂; 30.IV.22, ♂ et ♀ (Gough); 1.V.22, ☿ et ♀ (Gough); 4.VI.13, ♀ et ♂ (G. Storey); 8.VI.12, ♂; 17.VI.13, ♀ (G. Storey); 24.VI.12, ♀; 12.IX.15, ♂. — Giza, 1.I.13 à 30.X.13, ♂♂ (Naguib). — Cairo, 15.VI.16, ♂ (sur Lebbekh); 1, 2 et 11.VI.17, ☿☿ et ♀♀; 20.II.15, ♀ (Naguib). — Zeitoun, 11.V.25, ♂ et ♀ (Mistikawi). — Meadi, 14.V.12 et 22.VI.13, ♂♂; 5.VI.16, ☿ (L. H.

Gough) ; 6.IV.13, ♂ (L.H. Gough). — Fayoum, 28.IV.14, ♀. — Shubra, 6.V.16, ♂ (Adair). — Boulac El Wahat, 5.IX.15, ☿ (on dates).

J'ai reçu la même race de la Mecque.

Camponotus (*Myrmoturba*) *maculatus* F.st. *aegyptiacus* Em. var. *hyksos* nov.

☿ (media major). — Longueur 11,5-12 mm. — Tête : longueur 3,5 mm., largeur 3,2 mm. ; scape 2,5 mm. ; tibias postérieurs 3,4 mm.

Couleur des pattes comme chez *aegyptiacus*. Tête, mandibules, scape et dos du pronotum d'un brun-rougeâtre foncé, plus clair sur le mesonotum. Funicules, reste du thorax, tibias et tarses rouges un peu foncés. Ecaille, hanche et cuisses roux-jaunâtre clair. Diffère surtout de *aegyptiacus* par les taches du gastre qui sont réduites à deux petites taches roussâtres sur le devant du premier tergite et une plus petite arrondie, placée vers le côté du bord antérieur du deuxième tergite. Une tache, plus floue, se devine sur le troisième tergite. Le reste est brunâtre avec les bords postérieurs des segments jaunâtres (chez *aegyptiacus* les taches claires du gastre sont beaucoup plus grandes et plus allongées, même chez les individus de plus grande taille et la tête plus noirâtre). La fine réticulation ponctuée de la tête est légèrement plus accusée que chez *aegyptiacus* et aussi mate. Les mandibules très finement réticulés ont une ponctuation pilifère oblique plus nette. Pilosité dressée, jaune, disposée comme chez *aegyptiacus* mais avec une dizaine de poils sous la tête, celle-ci paraît plus courte, pour le reste comme chez *aegyptiacus*.

Le Caire (A. Borcard), 1 ☿, reçue avec une série de *aegyptiacus* type avec laquelle je l'avais confondue.

Camponotus (*Myrmoturba*) *compressus* F. st. *thoracicus* F. var. *delta* nov.

L'ouvrière major est exactement colorée comme chez la var. *beta* Sant., c'est-à-dire que la tête, avec les mandibules et les antennes, le thorax ainsi que les tibias et tarses sont d'un rouge-roussâtre foncé. L'épinotum un peu plus clair, le scape un peu plus obscur, l'extrémité du gastre d'un brun-roussâtre flou, le reste d'un ocre-roussâtre. Les ouvrières média et minor diffèrent de la var. *beta* en ce qu'elles sont entièrement d'un jaune-roussâtre avec, seul, le bout du gastre rembruni, tandis que chez *thoracicus* type et la var. *beta*, la tête de l'ouvrière média minor est de même couleur que chez la grande (brune chez *thoracicus*, roux foncé chez *beta*), et tranche nettement sur la couleur jaunâtre-clair du reste.

☿ (major). — Longueur 13 à 14 mm. — Tête longue, sans les mandibules 4 mm., large 3,8 mm.

♂. — Longueur 11 mm. — Entièrement noir-roussâtre clair avec la moitié postérieure de la tête, les scapes et les deux derniers segments du gastre brun-noirâtre passant par place au brun-rougeâtre foncé. Epistome, trois bandes sur le mésonotum, les deux tiers antérieurs des segments du gastre

rougeâtres. Aile légèrement jaunâtre avec les nervures rousses. Le reste comme chez *oasium*.

Mariout : 10.III.14, ☿☿ et ♂ ; 12.XI.13, ☿☿.

Camponotus (*Myrmoturba*) *compressus* F. st. *thoracicus* F. var. *fellah* Em.

Bir Sheb, 25.I.28, ☿. — Bir Tarfawi, 22.I.28, ☿. — Wadi Digla, 7.XI.23, ☿. — Wadi Hof, 3.IV.14 et 27.X.16, ☿☿. — Kantarah, 16.IX.25, ☿ et ♀. — Cairo, 9.IV.16, ♂.

Camponotus (*Myrmoturba*) *compressus* F. st. *thoracicus* F. var. *herodes* nov.

☿. — Longueur 14 mm. — Tête large de 4,2 mm., longue de 4,6 mm. Scape de 4,3 mm. Forme plus obscure que *fellah* Em. et *xerxes*. Noire y compris l'écaille et les côtés du thorax. Bord fléchisseur de la moitié basale des cuisses, dessus des hanches et tarses rougeâtres. Funicules, condyle des scapes et trochanters roussâtres. Il y a souvent quelques poils sous la tête. Chez *fellah* l'écaille, les hanches et les cuisses sont d'un rouge-brunâtre clair, ainsi que le bord fléchisseur de la première paire. Le funicule, le tiers antérieur des cuisses, et parfois une tache à la base du gastre, d'un brun-rouge foncé. Chez *herodes*, le thorax des plus petits exemplaries reste foncé, brun-noirâtre jusque vers sa base. Les appendices roux-brunâtres, plus clairs vers leur base. Chez *fellah* le thorax est plus rouge-brunâtre et les pattes plus claires.

Cette forme a déjà été remarquée par Karawaiev qui l'a confondue avec la var. *xerxes* de l'Asie. Je possède un exemplaire major du Caire reçu de Monsieur Karawaiev, qui l'a récolté lui-même, et d'autres individus de diverses tailles. Ils se distinguent de *xerxes* par les pattes plus foncées (aussi claires chez *xerxes* que chez *fellah*) et mates, les yeux moins grands, les arêtes frontales un peu moins écartées.

♂. — Longueur 12 à 13 mm., est aussi relativement beaucoup plus obscur que *fellah* et *xerxes*. Noir, sauf le funicule, les insertions alaires, les trochanters, l'extrémité des hanches et des petits tarses qui sont roussâtres. L'aile antérieure est enfumée dans ses deux tiers externes et plus spécialement les cellules cubitale et radiale. L'écaille est plus basse, plus convexe derrière vers le sommet qui est transversal (échancré chez *xerxes*). Il a outre les mandibules, le scape, le bord du pronotum, les hanches, cuisses et les tibias brun marron ; le funicule, les trochanters et les métastarses, les articulations des pattes rougeâtre plus ou moins clair. Le *C. xerxes* est remarquable par les yeux plus grands que chez *fellah* et encore beaucoup plus que chez *compressus* type.

Je possède comme type les exemplaires du Caire (Karawaiev) qui sont particulièrement caractéristiques.

Suez desert, « ☿ < ☿ » (Bugnion). — Wadi Digla : 22.IV.16. ☿ ; 13.III.27. — 7th Tower (Suez Road), 30.IV.14, ☿. — 6th Tower (Suez Road) : 20.IV.14, ☿ ; 8.XI.12, ☿ et ♂. — Mahatta Maskara, 25.III.24, ♂.

* *Camponotus* (*Myrmosericus*) *micans* Nyl.
Salloum, 5.VIII.17, 1 ♂.

Camponotus (*Orthonotomyrmex*) *sericeus* F.
Wadi Tawawid (S.E. Mersa Matrouh), 23.III.27, ☿. — Dakla Oasis, 11.V.18, ☿.

Paratrechina (s. str.) *longicornis* Lat.
Cairo, 3.XII.19, ☿ « on maely bug ». — Ismailia, 2.IX.24, ♀.

Paratrechina (*Nylanderia*) *joegerskioeldi* Mayr.
Meadi : 13.IV.14. ♂ et ♀ : 25.IV.16, ♂ et ☿ : 10.IV.12, ♀ ; 28.I.15, ♂ et ♀. — Marg, 1.II.13, ♀ (on Tamarix). — Wadi Tawawid, 23.III.27, ☿ — Ghezireh, 12.IV.25, ☿ « on root of cotton plant infested by *Aphis* (*T. plastedi*) ». — Alexandrie, 5.VIII.34, très communs dans les divers jardins de la ville où je les ai capturés moi-même. La var. *borcardi* (1908) est synonyme au type.

* *Cataglyphis* (*Monocombus*) *cursor* Forel st. *aenescens* Nyl.
Wadi Digila, 13.III.29, 1 ☿.
Forme balkanique signalée pour la première fois en Egypte.

Cataglyphis (*Machaeromyrma*) *bombycina* Rog.
Bir Sheb, 25.I.28, ☿. — Bir Kassaba, 26.I.28, ☿. — Abu Rowash, 21.III.25, ☿. — Borgash, 5.VII.25. — Kharga oasis, 10.XI.24, ☿ ; 12.III.24, ♀. — Desert near Giza, 9.II.14, ☿ .— Baharia oasis, 26.II.16, ☿. — 6th Tower (Suez Road), 20.IV.14, ☿. — Pyramids, 3.VIII.13, ☿.

* *Cataglyphis* (*Cataglyphis*) *albicans* Rog. var. *opaca* Santschi.
Wadi Hof, 3.III.16, 1 ☿.

Cataglyphis (*Cataglyphis*) *albicans* Rog. st. *rubra* Forel var. ?
Mariut, 23.IX.16, 2 ☿☿.
Une ouvrière moyenne de la coloration de *rubra*, 1 ☿ moyenne bien plus foncée. Il faudrait un matériel plus complet pour juger de la situation de cet insecte.

Cataglyphis (*Cataglyphis*) *albicans* Rog. st. *livida* And. var. *ambigua* Santschi.
7th Tower (Suez Road), 13.X.26, ☿.

* *Cataglyphis* (*Cataglyphis*) *albicans* Rog. st. *livida* And. var. *arenaria* Forel.
Wadi Assiuti, ☿ 2.IV.17.
Variété très voisine de *aurata* Kar. dont elle ne diffère que par la pubescense de la face postérieure de la tête beaucoup moins distincte.

* *Cataglyphis* (*Cataglyphis*) *bicolor* F. st. *nodus* Brul. var. *oasium* Santschi.
Meadi, 12.II.13, ☿.

Cataglyphis (*Cataglyphis*) *bicolor* F. st. *nodus* Brul. var. *desertorum* Forel.
Meadi : 8-15.VI.12, ☿ et ♀ ; 17.XII.12, ☿ ; 4.I.13, ☿ ; 10.III.15, ♀. — Dakhla oasis, 17.IV.17, ☿. — Nawa, 5.I.13, ☿. — Fayum, 14.I.14, ♀ et ☿. — Giza, 7.III.21, ☿. — Abu Rowash, 26.VIII.25, ☿.

Cataglyphis (*Cataglyphis*) *bicolor* F. st. *nodus* Brul. var. *savignyi* Duf.
Salloum, 25.V.17, ☿. — Caire, 13.I.25, ☿. — Suez, 20.V.14, ☿.

Cataglyphis (*Cataglyphis*) *bicolor* F. st. *nigra* And. var. *pharao* Santschi.
Wadi Assiuti, 2.IV.17, ☿. — Kafr Hakim, 11.XI.25, ☿.
Plusieurs ♂♂ de *Cataglyphis* pris isolément ne sont pas identifiables.

Aux 80 formes de fourmis citées par Finzi dans sa liste de 1936, la présente étude ajoute 18 formes nouvelles (dont 9, soit 6 variétés), 2 stirps et 1 espèce sont inédites) et 9 formes, déjà connues, mais manquant dans l'énumératoin de Finzi. Elles sont indiquées par un *.

A new *Trialeurodes* on Zizyphus

(Hemiptera : Aleurodidae)

(with 3 Illustrations)

by Prof. Dr. H. Priesner and Mahmoud Hosny, D.I.C., F.E.S.

Trialeurodes porosus spec. nov.
(Figs. 1-3)

Pupa case : No conspicuous wax secretion. Transparent yellowish, elliptical, with a slight emargination at the end of the anal furrow ; length 1.13-1.19 mm., breadth 0.84-0.87 mm. (exceptionally small specimens (? males), length 0.88-0.9, breadth 0.61-0.63 mm.) ; margin of pupa case distinctly crenulate with about 20 small, rounded notches for a length of 70 μ. No submarginal area separated ; close to the margin, about 14-18 μ distant, there is a circle of papillae all around the body, numbering about 100-120 ; these papillae are somewhat irregular in size and shape, conical, but rounded at tip or *bluntly* pointed. In cephalic region, medianly, between the anterior dorsal bristles, there is a conspicuous keel. In thoracic region, there are several distinct pores of unequal size, i.e., 6 to 7 pairs, as indicated in fig. 1 ; these pores show net-like structure ; in the abdominal region, there are three longitudinal rows of pores : one complete median row of 6 pores, the first of which is situated at the hind margin of the metathorax, and 3-5 pairs of lateral pores (fig. 1) ; an additional pair may be seen in the submarginal region but this is seldom well developed. At the margin of the pupa case, there is a pair of bristles of about 28-35 μ length, anteriorly, in thoracic region, a pair of stout dorsal bristles (about 90 μ), a somewhat shorter one at the hind margin of the thorax, an anal pair of about 95 μ, and a much smaller lateral pair, posteriorly ; two ventral and one dorsal pairs of setae are situated around the vasiform orifice ; the orifice is practically circular with only a notch in the middle, posteriorly, and with the inner surface somewhat denticulate ; length of orifice 72, width 70-72 μ ; operculum filling the orifice, ab. 53 μ in length, 45-47 μ in breadth, cordiform, with fore margin straight ; lingula obscured and entirely covered by the operculum ; a deep and sharply defined caudal furrow extends from the orifice to the apex of the abdomen.

Of this genus, there are about 50 species known ; we have compared with the descriptions of all of them, except some neotropical forms, the descriptions of which were not yet available. In most of the species of this genus, the operculum does not fill the orifice, and thus the lingula is not

obscured; all these, naturally, are different; in others, the number of submarginal papillae is less or, there are several rows of papillae, or either the caudal furrow or the pores are wanting, or, at least, there is no central row of pores.

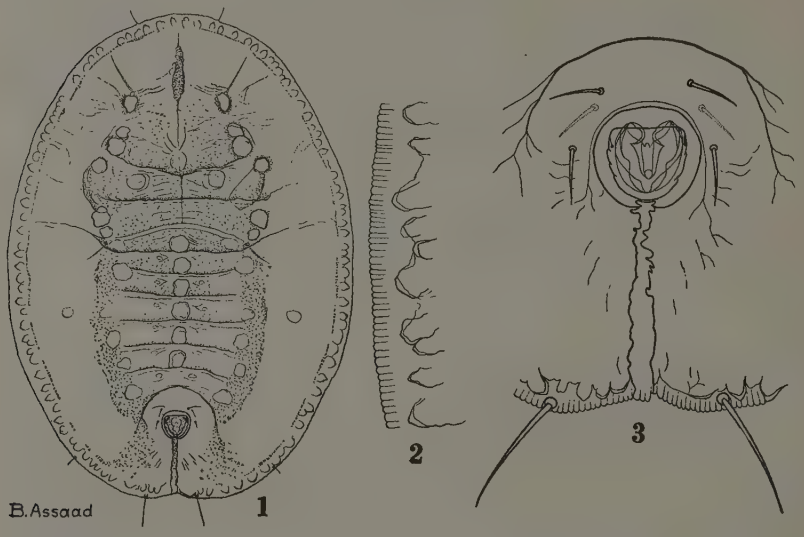


Fig. 1. — *Trialeurodes porosus* spec. nov.: Pupa case.
Fig. 2. — *Trialeurodes porosus* spec. nov.: Posterior part of pupa case, greatly enlarged.
Fig. 3. — *Trialeurodes porosus* spec. nov.: Posterior part of pupa case, greatly enlarged.

T. porosus seems to come close to *T. perakensis* Corbett, but in this species, the papillae are far from one another, irregularly placed, somewhat distant from margin, and the general outline of the pupa case is different, more pointed towards apex, in *perakensis*.

Habitat: *T. porosus* seems to be well distributed over Egypt, though it is not a common insect. We found it first at Assiout, on 2nd March, 1932, and later in the year it was collected by M. Kasim Eff. near Cairo (Shoubra, 15th June), in both cases on the under side of leaves of *Zizyphus spina-christi*. Other stages than the pupa case are not yet known.

Séance du 15 Mars 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-President.*

Distinctions honorifiques :

Le Président est heureux d'annoncer que deux distingués membres de notre Conseil d'Administration ont été récemment promus au grade de Pacha et de Bey Les membres du Conseil se joignent à leur Président pour féliciter et acclamer S.E. Fouad Abaza Pacha et Said Bahgat Bey, titulaires respectifs de ces distinctions honorifiques bien méritées.

Les préparations à base de nicotine employées en agriculture. Observations sur le dosage de la nicotine

par Clément R. Shabetai, Dipl. H.A., I.C.S., D.U.P.

Professeur à la Faculté d'Agriculture de Ghizeh (Egypte)

L'emploi des préparations à base de nicotine s'est vulgarisé au point que l'usage de ces préparations est devenu commun en Agriculture. La plupart des insectes nuisibles à épiderme légère sont très sensibles aux solutions contenant de la nicotine, indépendemment de l'empoisonnement que détermine l'ingestion de cette substance par ces insectes.

Les plantes de grande culture, les plantes potagères, les arbres fruitiers, de même que les plantes d'ornement sont couramment débarrassées des pucerons, thrips et autres parasites par des solutions à base de nicotine, auxquelles on ajoute parfois, pour en augmenter l'adhérence, des substances comme le savon ou la paraffine.

Parmi ces insectes, les plus fréquemment rencontrés et dont les ravages sont les plus préjudiciables, il convient de citer :

Aphis gossypii (cotonnier et certains citrus), *Aphis maidis* (graminées), *Aphis punicella* (grenadier), *Thrips* spp. (cotonnier, céréales), *Retithrips aegyptiaca* (vigne), *Eriophyes vitis* (vigne), *Toxoptera graminum* (graminées),

Pterochlorus persicae (pêcher), *Hyalopterus pruni* (abricotier, pêcher), *Macrosiphum rosaefolium* (rosier), *Macrosiphum granarium* (céréales), *Schizoneura lanigera* (pommier), *Limothrips cerealium* (blé, orge), etc...

A la Station Entomologique de Bordeaux, la nicotine a été employée avec succès pour arrêter l'éclosion des œufs de *Vanessa cardui* dans une plantation d'artichauts. D'autres produits, tels que les arséniates de plomb et de chaux, les mélanges savon-pyrèthre, pétrole-huile de pin, certains liquides à base d'acide cyanhydrique s'étaient avérés inefficaces (1).

L'usage comme parasiticide de solutions contenant de la nicotine, obtenues par macération de tabac ou de feuilles de tabac dans l'eau, remonte à une époque assez réculée. Les extraits aqueux peuvent être obtenus à chaud ou à froid. Dans le premier cas, l'épuisement est presque complet au bout d'une quinzaine de minutes. Les pertes en nicotine par l'ébullition sont réduites au minimum en augmentant le volume de la solution et en la maintenant à une température légèrement inférieure à 100 degrés. A froid, la vitesse d'extraction de la nicotine dépend du degré de finesse et de la qualité du tabac employé. On peut épuiser les feuilles au bout de 3-5 heures ; pour les petites branches et les tiges il convient de laisser macérer toute une nuit (2). Pour des extractions industrielles, la nicotine peut être déplacée par un courant d'air, de vapeur sèche ou de gaz inertes à une température voisine de 150 degrés. Le tabac est disposé sur des claies qui sont introduites dans une étuve à plateaux chauffée à la vapeur ou par des résistances électriques. Les gaz sont introduits par un serpentin perforé à la base de l'étuve et sortent au sommet par une tubulure munie d'une valve (3).

Suivant un autre procédé (4), le tabac ou les déchets de tabac sont pulvérisés et mélangés à l'état sec avec environ 5% en poids de chaux vive. Le mélange, chauffé en vase clos, est distillé. Lorsque la température a atteint, dans l'appareil, 95 à 100 degrés, on fait arriver dans le mélange, avant la distillation, de la vapeur d'eau qui éteint la chaux. Le dégagement de chaleur produit par cette réaction favorise le dégagement de la nicotine. Vers la fin de la réaction, la vapeur surchauffe la masse et la distillation s'effectue à 150-160 degrés. Les gaz non condensés sont recueillis dans l'acide sulfurique étendu, qui est ensuite mélangé au produit de la distillation et le mélange est évaporé. Le résidu de la distillation peut être utilisé comme engrais.

Un autre procédé d'extraction de la nicotine du tabac consiste à traîter celui-ci avec de la chaux et extraire l'alcaloide avec le pétrole (kerosene). La solution est ensuite agitée avec l'acide sulfurique (5).

D'après N. A. Barbieri (6), le principe actif qui se trouve dans le tabac est la tabacine qui serait un glucoside acide azoté, soluble dans l'eau, insoluble dans l'éther. Traitée a froid avec un alcali à faible dose, la tabacine donnerait : un sucre réducteur non défini, un acide liquide, l'acide tabacique

et un principe basique toxique : le tabacol. Ce dernier, traité avec un alcali concentré à chaud, donnerait de l'ammoniaque et de la nicotine. L'auteur présume qu'il n'y a pas de nicotine bien définie, donc pas de nicotine synthétique et toutes les nicotines ne se ressemblent pas. Quant au tabacol, Barbieri le définit comme un liquide clair, dense, huileux et basique. Il s'oxyde rapidement et se transforme en un liquide brun rougeâtre. Il a une odeur âcre et piquante et émet entre 40 et 60 degrés des vapeurs irritantes provoquant de la toux et des vomissements. Il n'a pas d'action caustique proprement dite sur la peau, mais possède plutôt une action irritante de sinapisme. Il agit par ses vapeurs provoquant la mort immédiate des insectes sans altérer les étoffes, fourrures, les plantes vertes ou sèches.

C'est un poison du système nerveux par son action paralysante sur les ganglions.

L'industrie produit actuellement différentes préparations comme le nicotrol et surtout le sulfate de nicotine, dont la teneur en alcaloide varie généralement entre 35 et 40 %. Cette dernière substance est diluée avant l'usage dans la proportion de 1,5 à 2 pour mille. L'adjonction de savon augmente l'adhérence de la solution et détermine probablement aussi une exaltation du pouvoir parasiticide. Le savon peut être dissous dans la solution dilué de sulfate de nicotine au moment de l'usage, à la dose de $\frac{1}{2}$ %. D'autres produits peuvent être ajoutés aux solutions de nicotine pour en augmenter l'efficacité. F. Wilcoxon et A. Hartzell (7) ont comparé l'action d'une solution témoin de nicotine avec des solutions de même concentration contenant en outre, différents produits tels que le caseinate de chaux, le pétrol et l'oléate de soude. Le pouvoir d'adhérence et la toxicité ont été trouvés progressifs dans l'ordre cité, la nicotine seule étant la moins active. Quant au pouvoir de pénétration, il était nul avec la nicotine seule et assez sensible avec la nicotine additionnée de caséinate de chaux, de pétrol ou d'oléate de soude.

Les compositions commerciales de savon-nicotine perdent ordinairement une partie de l'alcaloide pendant le stockage. D'après C. C. Mac Donnell et J.J.T. Graham (8), les savons durs à la soude perdent leur nicotine un peu plus rapidement que les savons à la potasse. L'excès d'alcali ou d'acides gras serait sans influence. D'autre part, les savons à base d'huiles non siccatives perdent leur nicotine par volatilisation, tandis que la perte dans les savons à base d'huiles siccatives est due à la formation de produits de condensation insolubles. Toutefois, ces pertes peuvent être évitées en conservant les savons à l'abri de l'air.

De même, les solutions concentrées en nicotine fermentent lorsqu'elles sont renfermées dans un récipient imparfaitement clos ; il est donc nécessaire, pour éviter les pertes, d'empêcher l'accès de l'air au contact des solutions.

Ces considérations démontrent l'utilité de doser la nicotine dans les

divers produits industriels pour s'assurer de leur efficacité et déterminer le degré de dilution auquel on devrait les soumettre avant l'usage. Pour la caractérisation de la nicotine, la seule réaction vraiment spécifique est la réaction de Roussin. Elle consiste en la formation de cristaux d'iodonicotine, sous forme de belles aiguilles rouge-rubis, par l'action de l'iode sur la nicotine en solution étendue dans l'éther (9).

Quant au dosage de la nicotine, de nombreux travaux ont été effectués dans ce domaine. G. Bertrand (10) avait, dès 1899, étudié l'emploi de l'acide silicotungstique comme réactif des alcaloides. En 1909, G. Bertrand et M. Javillier (11) ont critiqué la méthode habituellement utilisée alors de Schloesing. Dans cette méthode la nicotine est extraite par lixivation à l'éther et l'ammoniaque; ces dissolvants sont chassés par distillation au bain-marie, puis par évaporation à l'air libre à la température ordinaire et la nicotine est estimée par titration à l'aide d'une solution d'acide sulfurique, le papier de tournesol servant d'indicateur. La critique de cette méthode par ces auteurs comportait : 1) la perte d'une partie de la nicotine par volatilisation pendant la distillation et l'évaporation; 2) l'incertitude du virage dans le titrage alcalimétrique dont l'appréciation, déjà difficile lorsqu'on opère avec de la nicotine pure, le devient plus encore en présence de substances étrangères entraînées par l'extraction; 3) l'influence perturbatrice apportée par certaines substances organiques que l'éther ammoniacal enlève au tabac, et qui, saponifiées, entraînent la salification partielle de la nicotine, de sorte qu'une partie de celle-ci ne se retrouve plus par le titrage final.

Pour parer à ces différentes lacunes, les auteurs ont décrit une méthode précise où l'on opère de la manière suivante : l'alcaloide est extrait par de l'acide chlorhydrique à 5 % au bain-marie bouillant et le liquide limpide est décanté après centrifugation. Le résidu est extrait 4 fois de la même manière et les liquides décantés réunis sont traités par une solution d'acide silicotungstique ou de silicotungstate de potassium à 10 ou 20 %; la liqueur abandonnée à elle-même pendant 48 heures est centrifugée et le précipité rassemblé est délayé dans de l'eau acidulée par de l'acide chlorydrique contenant quelques gouttes de réactif, et séparé de nouveau par centrifugation.

Le silicotungstate de nicotine est décomposé par de la magnésie calcinée et distillé dans un courant de vapeur d'eau pour l'entraînement de la nicotine. L'alcaloide est ensuite dosé par le titrage avec une solution diluée d'acide sulfurique (3,024 gr. par litre) en présence d'alizarine sulfoconjugée.

La méthode de Kissling (12) comporte le traitement du tabac pulvérisé et desséché, par une solution alcoolique de soude caustique (6 gr. NaOH dans 40 c.c. d'eau + 60 c.c. d'alcool à 90 degrés [dans le cas où l'on dose la nicotine dans un extrait, on ajoute du carbonate de calcium pour donner de la consistance au mélange]) et l'extraction dans un appareil de Soxhlet pendant 5 heures avec de l'éther. Le dissolvant est évaporé à basse tem-

pérature et le résidu est traité avec 50 c.c. d'une solution diluée de soude caustique (4 gr. par litre) et distillé dans un courant de vapeur d'eau. Le distillat contenant la nicotine (400-500 c.c. environ) est titré avec une solution 0,1 N d'acide sulfurique, la phénacétoline ou la teinture de cochenille servant d'indicateur.

M. Samejima et K. Katai (13) ont comparé les différentes méthodes connues pour le dosage de la nicotine. Ils ont trouvé que les méthodes de Kissling, Chapin, Okuda donnaient des résultats similaires, tandis que celles de Toth, Fodor et Reifenberg donnaient des chiffres légèrement inférieurs.

L. Frank (14) agite le tabac pulvérisé dans un cylindre à séparation gradué muni d'un tube d'évacuation latéral, avec de la potasse, de l'éther et de l'éther de pétrole. Dans un prélèvement clair du mélange éthéré filtré sur du sulfate de soude sec et lavé à l'éther anhydre, il estime la nicotine, après distillation du solvant, addition d'eau et filtration, par titrage avec de l'HCL 0,1 N, en présence de rouge congo. L'auteur estime que cette méthode, comparable à celles de Keller et de Toth, est plus rapide et plus précise que celle où l'extraction se fait au soxhlet.

E. Cox (15) recommande pour le dosage de la nicotine dans des solutions renfermant des impuretés organiques, de traiter ces solutions après acidification, par du trioxyde de tungstène. On titre ensuite directement avec de l'acide silicotungstique.

J. Burman (16) traite le tabac réduit en poudre, après en avoir déterminé l'humidité, par de la soude ou de la potasse à 30 % et avec du plâtre de Paris. Le mélange est introduit dans un flacon où l'on fait le vide pour éliminer l'ammoniaque. Il est ensuite agité avec de l'éther et filtré. Le résidu après évaporation du solvant est repris trois fois avec de l'éther et évaporé à sec. On dissout dans l'éther, on ajoute de l'eau distillée et, après avoir chassé l'éther, on titre avec l'HCL 0,01 N en présence de pourpre de bromocrésol.

L. Barta et E. Toole (17), pour le dosage de la nicotine dans la fumée de tabac, absorbent l'alcaloïde par du coton de verre imbibé d'acide sulfurique. Celui-ci est ensuite lavé et la solution, alcalinisée avec de la soude, est distillée dans un courant de vapeur d'eau. La nicotine est précipitée à l'état de picrate ; ce sel est décomposé par la soude et l'alcaloïde, entraîné par la vapeur d'eau, est titrée.

V.L. Nagy (18), pour le dosage de la nicotine dans la fumée de tabac également, précipite l'alcaloïde dans les eaux de lavage du coton de verre imbibé d'acide sulfurique, par l'acide silicotungstique. Le précipité, décomposé par une lessive alcaline, est distillé dans un courant de vapeur d'eau et la nicotine est titrée par l'HCL 0,1 N en présence de rouge de méthyl. D'après cet auteur, la pyridine ne fausse pas l'exactitude du dosage.

R. Hoffmann (19) dose la nicotine par précipitation sous forme de

silico-molybdate, réduction avec un révélateur photographique ammoniacal et enfin par colorimétrie de la réaction bleue obtenue. La précision de cette méthode n'est toutefois pas au-delà de 2 %.

E. Toole (20) n'ayant constaté aucune trace de nicotine racémisée dans le tabac dénicotinisé par chauffage à 160 degrés, ni dans la fumée de tabac, estime que le dosage peut être effectué, dans ces cas, par polarimétrie.

Parmi les autres travaux effectués sur le dosage de la nicotine, on peut consulter encore ceux de L. Ferré (21), M. Wagenaar (22) et V.D. Kutzenos (23).

Ayant eu à analyser de nombreux échantillons de sulfate de nicotine, j'ai eu l'occasion de faire quelques observations sur certaines méthodes d'extraction et de dosage. Pour les opérations de titrage, le virage avec des solutions 0,01 N paraît être insuffisamment précis avec les différents indicateurs préconisés. On sait que la nicotine donne avec l'acide sulfurique par exemple, deux sels :

$$(\text{nicotine})\ H^2SO^4 \text{ et } (\text{nicotine})^2\ H^2SO^4$$

D'après T.M. Lowry et W.V. Lloyd (24), dans des titrages électrométriques de la nicotine avec l'HCL, N, les deux points de neutralisation se trouvent à pH 5,52 et pH 1,52 (pH 6,61 et 3,04 déduits par Kolthoff avec l'usage d'indicateurs).

Pour mes mesures, j'ai trouvé préférable de traîter la solution de nicotine avec un excès d'acide sulfurique et de faire le titrage en retour avec de la soude caustique 0,01 N. Le virage que j'ai obtenu avec un nouvel indicateur, le vert de bromocrésol (pH 3,8-5,4) m'a paru suffisemment net, la réaction se terminant lors du virage de l'indicateur au bleu.

Un essai d'extraction de la nicotine avec l'éther de pétrole et le titrage de l'alcaloide directement au sein de la solution éthérée (25) a donné des résultats bien inférieurs à la réalité. J'ai fait usage de sulfate de nicotine pur contenant 44 % de nicotine; ce taux a été confirmé par une estimation précise de l'azote. Des solutions de concentration différente ont été préparées et des portions de 100 c.c. de ces solutions traitées avec 25 c.c. de soude caustique à 20 %, ont été extraites avec 100 c.c. exactement mesurés d'éther de pétrole sec. L'extraction s'est faite par agitation durant 20 minutes. Après avoir laissé reposer le mélange, 40 c.c. de la solution surnageante claire d'éther de pétrole, exactement mesurés, ont été prélevés et additionnés de 25 c.c. d'acide sulfurique 0,1 N. L'excès d'acide sulfurique a été déterminé par titration avec de la soude 0.1 N jusqu'à l'approche du virage et finalement avec de la soude 0,01 N.

Résultats

Concentration de la solution en grammes de sulfate de nicotine par litre.	Nicotine trouvée et calculée en % relativement à la solution originale (44 % de nicotine)		
10,3306	36,46	36,43	36,46
20,6612	36,6	36,6	36,6
50,4520	37,27	37,27	37,29
126,8530	38,48	38,68	38,54

Il en ressort que plus la solution est concentrée, plus le pourcentage de nicotine trouvée est élevé ; ce pourcentage demeure toutefois inférieur au chiffre correct de 44 %.

La nicotine étant soluble dans l'eau (*), l'extraction ainsi faite doit être incomplète, une partie de l'alcaloide demeurant dans la couche aqueuse. Pour le vérifier, j'ai fait usage d'une solution contenant 11 gr. 312 de sulfate de nicotine par litre. Quatre portions de 100 c.c. chacune ont été extraites comme précédemment, au moyen de 25 c.c. de soude caustique et 100 c.c. d'éther de pétrole.

Pour chaque essai, 40 c.c. de la solution éthérée claire ont été évaporés à la température ordinaire pour chasser le solvant et le résidu distillé dans un courant de vapeur d'eau. La nicotine a été estimée dans le distillat par précipitation à l'acide silicotungstique, suivant la méthode de Bertrand. Les résultats calculés en mgr. de nicotine pour 100 c.c. de la solution employée étaient :

364,8 ; 364,8 ; 364,0 ; 364,4 : moyenne 364,5.

La nicotine a été ensuite estimée, par la même méthode, dans les portions aqueuses alcalines. Elle était de :

130,5 ; 130,5 ; 132,0 : moyenne 131,0

La nicotine totale, partagée entre les deux couches serait donc de :

$$364,5 + 131,0 = 495,5 \text{ mgr.}$$

La quantité théorique est de :

$$\frac{11,312}{10} \times \frac{44}{100} = 0,4977 \text{ gr. ou } 497,7 \text{ mgr.}$$

(*) Au-dessus de 210 degrés et au-dessous de 60 degrés, la nicotine et l'eau sont miscibles en toutes proportions; de même avec des % de nicotine inférieurs à 6,8 et supérieurs à 82, le mélange est homogène à toute température (Hudson, 1904).

L'extraction de la nicotine par agitation avec un solvant et décantation du liquide surnageant, telle qu'elle est donnée par certains auteurs, paraît donc être incomplète. D'autre part, le dosage au moyen de l'acide silicotungstique est extrêmement précis. On peut cependant, pour abréger les opérations, lorsqu'une extrême précision n'est pas demandée :

1) séparer le précipité cristallin de silicotungstate de nicotine, après l'avoir laissé reposer pendant 24 heures, par simple filtration au lieu de le faire par la centrifugeuse. L'acide silicotungstique de formule 4 H^2O. Si O^2. 12 WO^3. 22 H^2O, dont j'ai fait usage et dont j'ai vérifié la proportion d'eau de cristallisation, donnait en effet des précipités cristallins qui se déposaient complètement laissant un liquide surnageant parfaitement clair.

2) sécher le silicotungstate de nicotine, le calciner soigneusement et peser le résidu de silice et d'oxyde de tungstène pour en déduire la proportion de nicotine (f = 0,114) (26).

Index des références mentionnées.

(1) Rapport sur le fonctionnement de l'Institut des Rech. Agr., Paris, 1928.

(2) A. Skibbe : Chem. News, t. 133, No. 3471, pp. 263-4.

(3) Brevet E.P. 290204 ; 9.5.1927 ; Gen. Direkt. Oester. Tabakregie, Autriche.

(4) Brevet 547.817 (C08) (44) ; E. Helin (France) : B.F. No. 660683 ; 25.2.929.

(5) G. O. Gabel et G. I. Kiprianos : Ukraine Chem. J., *4*, 109-116 (Tech.), 1929.

(6) A. Barbieri : Atti Accad. Lincei, *17*, 402, 1933.

(7) F. Wilcoxon et A. Hartzell : Contrib. Boyce Thompson Inst., 3.1-12, 1931.

(8) C. C. Mac Donnell et J. J. T. Graham, Ind. Eng. Chem., *21*, No. 1, 70-73, 1929.

(9) M. J.-A. Labat : Bull. Soc. Chim. B., *15*, 1339-43, 1933.

(10) G. Bertrand : Bull. Soc. Ch. (3e série), XX, 434, 1899.

(11) G. Bertrand et M. Javillier : Bull. Soc. phar., No. 1, 1909.

(12) Chem. Ztg. *30*, 631, 1906. — Dept. Agr. Chem. Bull., U.S.A., 85. — J. Ass. Off. Agr. Chemists, 6, 465, 1923.

(13) M. Samejima et K. Katai : Bull. Sci. Fak. Terkultura, *3*, 112-16, 1929.

(14) L. Frank : Chem. Ztg., t. 51, *68*, 658, 1927.

(15) E. Cox : Brevet U.S.A. P., No. 1.678.636, 30.I.1925.

(16) J. Burman : Helv. Chim. Acta, t. 13, 5, 785-7, 1930.

(17) L. Barta et E. Toole : Z. angew. Chem., *44*, 682-3, 1931.

(18) V. L. Nagy : Bioch. Z., *249*, 404-9, 1932.

(19) R. Hoffmann : Bioch. Z., *260*, 26-33, 1933.

(20) E. Toole : Z. Anal. Chem., *93*, 188-94, 1933.

(21) F. Ferré : Ann. Fals., *23*, 337-44, 1930.

(22) M. Wagenaar : Pharm. Weekblad., *66*, 773-76, 1929.

(23) V. D. Kutzenos : Ukraine Chem. J., *4*, 135-9 (tech.), 1929.

(24) T. M. Lowry et W. V. Lloyd : J. Chem. Soc., May 1932, 1926-34.

(25) R. R. Le G. Worsley : Bulletin No. 73, Ministry of Agric., Cairo.

(26) J. Ind. Eng. Chem., *1*, 27, 1909. — J. Assoc. Off. Agr. Chemists, 5, 547, 1932.

WISSENSCHAFTLICHE ERGEBNISSE DER ENTOMOLOGISCHEN EXPEDITIONEN SEINER DURCHLAUCHT DES FUERSTEN ALESSANDRO C. DELLA TORRE E TASSO NACH ÆGYPTEN UND AUF DIE HALBINSEL SINAI

X.

Curculionidae

(Coleoptera)

von C. Koch, München.

Gen. Otiorrhynchus

Otiorrhynchus (Tournieria) mersanicus Hust.

Mersa Matrouh, 18. und 19.3.1933 (25 Exemplare) ; Soloum, 23.3.1933 (2 Exemplare).

Die Art wurde während einer Sammelreise nach der Oase Siwah von Herrn Prof. H. Priesner und mir unter Steinen an der Meeresküste von Mersa-Matrouh erbeutet. Sie wurde von A. Hustache irrtümlich in einem Artikel über die « Curculionides du Gabal Elba » (1) beschrieben. Leider war sich der Autor über die von ihm angeführten Lokalitäten absolut im Unklaren, da er in seiner Arbeit Tiere aus dem anglo-ägyptischen Sudan, nahe der Küste des roten Meeres (welches Gebiet bereits nicht mehr zur Paläarktischen Faunenregion gehört) mit solchen von der westlichen, ägyptischen Mittelmeerküste (Mersa-Matrouh und Soloum) vermischt. Die Folgerungen, die der Autor aus dem geringen Material (17 Arten) auf die Zusammensetzung der Fauna vom Gebel Elba zieht, sind daher ohne Basis, da fünf Arten (also fast ein Drittel aller angeführten !) gar nicht vom Gebel Elba, sondern von der ägyptischen Westküste des Mittelmeeres stammen. Es sind dies *Ot. mersanicus* Hust., *Sit. ocellatus* Kirsch, *Sit. crinitus seriesetosus* Fahr., *Sibinia exigua* Faust und *Apion cretaceum* Rosh., zum Teil aus Mersa Matrouh, zum Teil aus Soloum herrührend.

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(1) *Bull. Soc. Roy. Ent. d'Eg.*, 1934, 139.

Nach der Meinung Dr. F. Solaris, Genua, dürfte diese Art eher in die Gruppe *Tournieria* s.str. (*Odopadus* Rtt.) zu jenen Arten gehören, bei denen die Flügeldecken auf der Scheibe und der Halsschild in der Mitte punktiert und nicht gekörnelt sind. Sie würde dann am nächsten mit dem griechischen *Ot. othryades* verwandt sein, mit dem sie mehr übereinstimmt, als mit *Ot. thaliarchus* Rtt., dessen Flügeldecken durch goldfarbige Haarschuppen ausgezeichnet sind.

Schwarz bis rotbraun, die Flügeldecken und die Unterseite heller, Beine rostrot.

Rüssel samt den Pterygien so lang wie breit, vorne so breit wie hinten, am Vorderrand in der ganzen Breite sanft ausgerandet, vor den Augen der Rücken mit fast parallelen Seiten, auf der vorderen Partie wenig geglättet, unregelmässig punktiert, auf der hinteren Hälfte in der Mitte mit scharfem Kiel, welcher in einem tiefen Grübchen zwischen den Augen entspringt und in einem dreieckigen Grübchen vorne endet, jederseits des Kieles der Länge nach schwach ausgehöhlt, die Seiten undeutlich kielartig emporgewölbt, grob punktiert, spärlich und quer behaart. Pterygien sehr gross und breit, der Rüssel vorne, zwischen den Pterygien, höchstens doppelt so breit wie diese. Fühlerfurchen breit, zur oberen Partie des Auges gerichtet, nach hinten vreschmälert, das Auge nicht ganz erreichend, oben unmittelbar vom Seitenrand der Rüssel-Oberfläche überdacht. Seiten des Rüssels kurz, aber ziemlich dicht behaart. Kopf vom Rüssel durch eine kräftige Querdepression getrennt, der Scheitel, von der Seite betrachtet, höher liegend als die Oberfläche des Rüssels, vorne grob und dicht, an der Stelle, wo der Kopf zum Rüssel abfällt, deutlich runzelig punktiert, hinten mit feiner, aber sehr dichter Punktierung, am Innen- und Hinterrand der Augen der Länge nach gerunzelt, rückwärts gegen den Innenrand der Augen zu spärlich behaart. Augen mehr seitenständig, ziemlich aus den Seitenkonturen der Wangen und Schläfen vorgewölbt, ihr Längsdurchmesser ungefähr so lang wie die Wangen, länger als die Schläfen, schief, ihre grösste Nähe befindet sich vorne, an dieser Stelle voneinander um etwas mehr als ihren eigenen Längsdurchmesser entfernt, diese Stelle übrigens deutlich breiter als die Nase. Schläfen nach hinten wenig erweitert. Halsschild um die Hälfte breiter als lang, in oder etwas hinter der Mitte am breitesten, mit stark gerundeten, zum Vorderrand etwas stärker als zur Basis verengten Seiten, grob, in der Mitte feiner und spärlicher punktiert, die Seiten und unmittelbar vor der Basis dicht, abgeflacht tuberkuliert, spärlich, kurz und quer, an den Seiten dichter hell behaart. Die dorsale Punktierung geht gegen die Seiten zu in dichte, wellige, flache Tuberkeln über, die auf den Seiten selbst stellenweise zu erhabenen, separiert stehenden Körnchen werden. Bei vielen Exemplaren ist durch die von den Seiten und von der Basis kommenden Tuberkulierung die Punktierung auf die Mitte mehr oder weniger beschränkt. Flügeldecken oval, gewölbt,

oben etwas abgeflacht, ungefähr doppelt so breit wie der Halsschild, zur Spitze steil abfallend, kurz, anliegend, gelblich behaart. Die Härchen sind im Durchschnitt von den folgenden oder den nebenstehenden ungefähr um ihre eigene Länge entfernt. In den Punktstreifen sehr grob und dicht, ungefähr dreimal so grob wie der Halsschild punktiert, die Streifen selbst am Flügeldeckenabfall tief eingegraben. Die Zwischenräume auf der Scheibe flach, ungefähr doppelt so breit wie die Punktstreifen, hinten gewölbt, auf der Scheibe glänzend, glatt, sehr fein eingestochen und sehr zerstreut punktiert, fein quer-rissig, gegen die Seiten und nach hinten zu, spärlich und flach, in Reihen, am Flügeldeckenabfall dicht und erhabener gekörnt. Unterseite spärlich, kurz, anliegend behaart, das Metasternum erhaben gekörnt, in der Mitte geglättet und punktiert, das erste sichtbare Sternit spärlich punktiert, querrissig, an den Seiten quergerunzelt, das zweite ebenso punktiert und fein querrissig, die folgenden dicht, das Analsternit äusserst dicht und ziemlich grob punktiert. Alle Schenkel kräftig gekeult, die Vorderschenkel mit grossem Zahn, davor mit mehreren, oft undeutlichen, kleinen Zähnchen, die Mittel- und Hinterschenkel mit sehr feinem Zähnchen. Vorderschienen lang, innen auf der apikalen Hälfte bedornt, an der Spitze nach innen erweitert, Mittel- und Hinterschienen innen nur behaart oder mit feinen Körnern besetzt, an der Spitze nach innen, aber auch schwach nach aussen erweitert. Fühler lang, die Geissel dicht und greis gelb behaart, fast um ein Drittel länger als der Schaft. Basalglied langgestreckt, ca. dreimal so lang wie breit, nur wenig länger als das zweite Glied, dieses 2½ bis 3 mal so lang wie breit, das dritte Glied nur mehr halb so lang wie das zweite, um die Hälfte länger als breit, die folgenden Glieder untereinander ungefähr gleichlang, etwas länger als breit : das vierte kürzer als das dritte, das fünfte wieder etwas kürzer als das vierte, kaum länger als breit, das sechste wenig länger als das fünfte, ungefähr dem vierten in der Länge entsprechend, das siebente länger als das sechste, ungefähr um ein Drittel länger als breit. Die Keule ist schmal, langgestreckt, kurz, fein gelb tomentiert, ungefähr so lang wie die drei vorhergehenden Glieder zusammengenommen.

Länge : 5½ bis 7½ mm.

Otiorrhynchus (Arammichnus) trophonius Rtt.

Heluan, 11.3.1933 (mit Exemplaren dieser Art aus Malta übereinstimmend).

Otiorrhynchus (Arammichnus) Torre-Tarroi nov. spec.

Mersa Matrouh, 16. und 17.3.1933.

Dunkel rötlichbraun bis schwarzbraun, am Flügeldeckenabfall hell rötlich, die Beine rotbraun bis gelbrot, die Spitzen der Schenkel meist angedunkelt.

Rüssel samt den Pterygien breiter als lang, an der Fühlerwurzel eingeschnürt, von dieser Stelle sowohl zum Vorderrand als auch zu den Augen erweitert, oben mit dem Scheitel in einer Ebene liegend, die Nase fast schmäler als der Scheitel, auf der vorderen Hälfte abgeplattet, glatt, nur an den Seiten unregelmässig punktiert, vorne fast gerade abgestutzt oder schwach ausgerandet, auf der hinteren Hälfte grob und sehr zerstreut punktiert. Auf der Nase befindet sich ein tiefes, dreieckiges, meist nach vorne zugespitztes Grübchen. Auf der Oberseite und Unterseite fast kahl, glänzend, an den Seiten dicht, weiss behaart. Pterygien gross, nicht den Rüssel nach vorne überragend, die Fühlerfurche zur unteren Hälfte des Auges verlaufend und dieses erreichend. Kopf grob, aber sehr zerstreut, am Innenrand der Augen dichter punktiert, fast kahl, hinten am Scheitel mit einem, kleinen medianen Grübchen, welches selten durch eine flache Längsdepression mit dem Nasengrübchen verbunden ist. Augen gross, dorsal gelegen, an ihrem Vorderrand ungefähr um ein Viertel weiter von einander entfernt als im Durchmesser lang, nicht aus den Seitenkonturen des Kopfes vorspringend, die Schläfen nach hinten kräftig erweitert, etwas kürzer als die Augen, ihre Konturen mit jenen der Augen und der Wangen eine kontinuierliche, nach vorne verengte Linie bildend. Hinter den Augen ist der Kopf vollkommen punktfrei. Unterseite des Kopfes weiss behaart. Halsschild gewölbt, deutlich breiter als lang, mit kräftig gerundeten Seiten, die zum Vorderrand etwas stärker als zur Basis eingezogen sind, in der Mitte am breitesten, auf der Scheibe spärlich und grob, dazwischen unregelmässig, sehr fein eingestochen punktiert, am Vorderrand, vor der Basis und gegen die Seiten zu wird die Punktierung dichter, stellenweise sehr dicht. In der Mitte befindet sich ein mehr oder weniger breiter, punktfreier Längsraum, der jedoch weder den Vorderrand noch die Basis erreicht. Auf der Scheibe fast kahl, die Seiten sehr dicht, greis behaart. Flügeldecken gewölbt, an ihrer breitesten Stelle fast doppelt so breit wie der Halsschild, mit abgeschrägten Schultern, mässig gerundeten Seiten, zur Spitze steil abfallend. Die Punktstreifen viel schmäler als die Zwischenräume, auf der Scheibe dicht und gröber als der Halsschild, am Flügeldeckenabfall undeutlich punktiert, die Streifen selbst jedoch tief eingegraben. Die Zwischenräume auf der Scheibe flach, an den Seiten und vor der Spitze stark gewölbt, auf der Scheibe nur sehr spärlich und ganz abgeflacht, gegen die Seiten zu, besonders am Flügeldeckenabfall stark, dicht und erhaben gekörnelt. Auf der Oberseite in Reihen geneigt abstehend, gelblich beborstet, diese Behaarung jedoch meist nur am Flügeldeckenabfall und an den Seiten vollständig entwickelt. Abdomen zerstreut und grob punktiert, spärlich behaart. Schienen an der Spitze stärker nach aussen als nach innen erweitert, Schenkel stark gekeult, ohne Zähnchen, wie die ganzen Beine weiss behaart. Fühlergeissel etwas länger als der schlanke, zur Spitze plötzlich kräftig erweiterte Schaft, die beiden ersten Glieder ungefähr um die Hälfte länger als breit, untereinander

fast gleichlang, das dritte Glied nur mehr wenig länger als breit, bedeutend kürzer als das zweite, die folgenden knopfförmig, das siebente Glied etwas schmäler als das sechste, die Keule gross, breit, gelbrot, gelb tomentiert, symmetrisch, fast so lang wie die vier vorhergehenden Fühlerglieder zusammengenommen.

Länge : 4 ¼ mm. bis 4 ½ mm.

Gehört zu den *Arammichnus* s.str. Durch den einfach punktierten Halsschild, die langen, feinen Fühler, deren Keule länger als die drei vorletzten Glieder ist, durch den nach hinten konisch erweiterten Rüssel und durch auf den Flügeldecken fehlenden Zwischenbehaarung (es sind nur Börstchenhaarreihen vorhanden !) in die Verwandtschaft des *Ot. gravidus* Strl. zu stellen, von diesem verschieden durch oberflächlichere und viel zerstreutere Punktierung des Halsschildes, durch die nicht gefurchten Punktreihen auf den Flügeldecken und nicht tief gefurchten Rüsselrücken.

Seiner Durchlaucht, dem Fürsten Alessandro C. della Torre e Tasso, Herzog von Duino, in Dankbarkeit gewidmet.

Otiorrhynchus (Arammichnus) auladalinus nov. spec.

Soloum, 23.3.1933.

Hell rotbraun, die Flügeldecken heller als Kopf und Halsschild.

Rüssel samt den Pterygien breiter als lang, ähnlich wie bei *Torre-Tassoi* geformt, aber die abgeflachte Vorderpartie schwach geneigt, mit dem Scheitel nicht in einer Ebene liegend, nach hinten schwächer erweitert, die Nase deutlich breiter als der Scheitel zwischen den Augen, oben auf der abgeflachten Vorderpartie zerstreut, auf der hinteren Hälfte unregelmässig, grob und teilweise runzelig punktiert, zwischen den Fühlerwurzeln mit tief eingegrabenem Längsgrübchen. Pterygien und Fühlerfurche wie bei *Torre-Tassoi* nov. Kopf grob punktiert, zwischen den Augen mit tief eingegrabenem Längsgrübchen, an der Stelle des geringsten Augenabstandes fast nur so breit wie ein Auge lang, viel schmäler als die Nase, spärlich, aber deutlich behaart. Augen gross, einander sehr genähert, dorsal gelegen, aus den Seitenkonturen des Kopfes schwach, aber deutlich vorgewölbt, ihr Durchmesser ungefähr so lang wie die Wangen, kürzer als die nach hinten kräftig erweiterten Schläfen. Halsschild um ein Viertel breiter als lang, in der Mitte am breitesten, mit schwächer gerundeten Seiten, welche zum Vorderrand kaum mehr als zum Hinterrand verengt sind, sehr grob und dicht, kaum feiner als die Flügeldecken punktiert, in der Mitte mit punktfreiem Längsraum, auf der Scheibe spärlich, an den Seiten dicht behaart. Flügeldecken oval, mit mässig gerundeten Seiten, an ihrer breitesten Stelle nicht ganz doppelt so breit wie der Halsschild, gewölbt, hinten steil zur Spitze abfallend. Die Punktreihen auf der Scheibe schmäler als die Zwischenräume, seitlich ebenso breit, weniger tief eingedrückt, grob und weniger dicht punk-

tiert, am Flügeldeckenabfall ist die Punktierung, obwohl feiner, deutlich wahrnehmbar. Die Zwischenräume auf der Scheibe flach, gegen die Seiten zu und am Flügeldeckenabfall gewölbt, überall, auch auf der Scheibe in Reihen gekörnt und ebenso gelblichweiss, stark geneigt abstehend behaart, die Körner gegen die Seiten, besonders aber zur Spitze zu, spitziger und erhabener. Abdomen gelbrot, fast glatt, nur sehr spärlich behaart und punktiert. Beine und Fühler ähnlich jenen des *Torre-Tassoi*, nur schlanker, an den Fühlern noch das vierte Glied deutlich länger als breit, die drei folgenden Glieder weniger knopfförmig, das siebente Glied nicht schmäler als das sechste, die Keule schlanker, assymmetrisch.

Länge : 4 bis 4 ¼ mm.

Am nächsten verwandt mit der vorher beschriebenen Art, von ihr spezifisch verschieden durch einander viel mehr genäherte Augen, durch etwas kleinere Gestalt, hellere Färbung, stärker behaarte Oberseite und die Bildung der Fühler. Während bei *Torre-Tassoi* nov. das siebente Glied etwas schmäler als das sechste und die Keule breiter und symmetrisch ist, besitzt *auladalinus* eine langgestreckte, assymmetrische Fühlerkeule und ist das siebente Glied fast etwas breiter als das sechste.

Nach dem grossen, die Gebiete von Mariout bewohnenden Beduinenstamm der Aulad Ali (=Kinder Alis) benannt.

Otiorrhynchus (Arammichnus) hellenicus Strl.

Aboukir, 1.4.1933 (zusammen mit *Brachyesthes* an den Wurzeln von Pflanzen des Meeresstrandes gefunden); Mex bei Alexandrien, 3.4.1933; Dekeihla bei Alexandrien, 5.4.1933; Hammam, 15.3.1935; Mersa Matrouh, 16.3.1933.

Liste der bisher aus Aegypten bekannten Otiorrhynchus-Arten

(*Ot. arachniformis* Rtt., der im Katalog von Winkler unter No. 1812 angeführt ist, findet sich richtig als *Eptacus arachniformis* Rtt. unter der No. 2375 wieder. Die No. 1812 ist daher zu streichen !).

1. *Ot.* (*Tournieria*) *mersanicus* Hust.: Westliches Mediterranägypten; 2. *Ot.* (*Arammichnus*) *histrio* Gyll.: Nilägypten. Von Reitter aus Kairo angeführt; 3. *Ot.* (*Arammichnus*) *trophonius* Rtt.: Nilägypten; 4. *Ot.* (*Arammichnus*) *Torre-Tassoi* nov. spec.: Westliches Mediterranägypten, 5. *Ot.* (*Arammichnus*) *auladalinus* nov. spec.: Westliches Mediterranägypten; 6. *Ot.* (*Arammichnus*) *hellenicus* Strl.: Mediterranägypten.

Assemblée Générale Ordinaire du 22 Mars 1937

Présidence de M. le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Rapport du Secrétaire Général (exercice 1936) :

Messieurs,

Un double deuil nous a profondément éprouvés au cours de l'exercice 1936.

Sa Majesté le Roi Fouad 1er, notre Haut Protecteur, auquel la Société doit son merveilleux développement, s'est éteint dans la consternation et le regret unanimes.

Qu'il nous soit permis d'exprimer ici à Son successeur, Sa Majesté le Roi Farouk 1er, l'hommage de notre respectueux dévouement et l'assurance que la mémoire de Son Glorieux Père restera à jamais vivante et vénérée dans notre Société.

Quelques jours plus tard devait s'éteindre notre regretté Président, Son Excellence le Docteur Mohamed Shahine Pacha.

Les panégyriques de Sa Majesté le Roi Fouad 1er et de Son Excellence le Docteur Mohamed Shahine Pacha ont été lus en séance du Conseil d'Administration et publiés dans notre récent Bulletin.

Le successeur au fauteuil présidentiel laissé vacant par Son Excellence le Docteur Mohamed Shahine Pacha devant être nommé par Décret, conformément à l'Article 1er de nos Statuts, votre Conseil d'Administration a constitué un Comité chargé de soumettre la question à Son Excellence le Président du Conseil des Ministres. Ce Comité a été reçu en audience par Son Excellence le Président du Conseil qui a bien voulu nous donner l'assurance que notre requête recevra toute sa bienveillante attention.

Au mois d'Avril s'est tenu dans notre Siège la IVème Conférence Internationale pour les Recherches Anti-Acridiennes. Cette réunion au Caire des sommités mondiales en matière d'entomologie leur a permis d'apprécier davantage nos travaux. Il nous est agréable d'ajouter que de nombreuses lettres d'admiration et de félicitations nous sont parvenues à cet égard.

A l'occasion de la Conférence précitée, le Ministère de l'Agriculture nous a fait parvenir 200 livres égyptiennes, destinées à effectuer diverses réparations de notre local et d'entreprendre l'embellissement de notre jardin. Nous avons également reçu les remerciements de Son Excellence le Ministre de

l'Agriculture pour la part active prise par notre Société au succès de cette Conférence et pour l'aide fournie à ses organisateurs.

Peu de temps avant sa mort, notre Président avait entrepris des démarches auprès de Son Excellence le Ministre des Finances en vue du remboursement des 5000 livres égyptiennes prélevées sur notre capital lors des travaux d'extension de notre local. D'autre part, il avait exposé à Son Excellence le Ministre de l'Agriculture la situation financière de la Société, le priant de bien vouloir doubler le montant de la subvention annuelle qui nous est accordée par son Ministère. Malheureusement, ces démarches sont restées sans résultat, le Comité des Finances n'ayant pu en approuver les crédits. Par conséquent, nous avons dû restreindre toutes nos dépenses, différer la publication de la seconde partie de la Monographie des Asilides d'Egypte destinée à nos Mémoires, et suspendre tous les achats et reliures pour la bibliothèque.

Nous avons reçu cette année, comme par le passé, la subvention de L.Eg. 500 qui nous est accordée par le Ministère de l'Agriculture. Nous nous permettons d'en remercier Son Excellence Ahmed Hamdi Seif el Nasr Pacha, Ministre de l'Agriculture, et lui exprimer ici toute notre reconnaissance pour les marques d'intérêt qu'il nous a témoignées.

L'organisation de nos diverses collections est en constante progression. D'importantes donations ont enrichi notre matériel entomologique, notamment les Orthoptères, Hémiptères, Hyménoptères, Névroptères et Odonates.

Le nombre d'ouvrages reçus en échange cette année est particulièrement important. Un inventaire de tous les ouvrages et périodiques existants dans notre bibliothèque est en cours. Un numéro d'ordre est donné à chaque publication et inscrit sur un registre spécial qui sera constamment tenu à jour.

Des démarches entreprises auprès des autorités compétentes nous ont permis de bénéficier d'une importante réduction de nos impôts.

Le nombre de nos membres est stationnaire. Le public qui a visité notre Musée ou consulté notre bibliothèque a dépassé toute prévision.

Il vous a été distribué en Décembre notre Bulletin 1936, contenant des travaux remarquables sur notre faune. Malgré la hausse du prix du papier, notre imprimeur nous a consenti, sur ce Bulletin, une réduction de 10 % sur les prix antérieurs.

Sur la proposition du Trésorier, votre Conseil a décidé de supprimer les comptes Donations et Divers figurant sur les Situations précédentes et de porter ces montants sous une nouvelle rubrique « Réserve ». Il a également décidé d'amortir les comptes Bâtiment, Laboratoire, Bibliothèque, Collections, Mobilier et de les porter à L.E. 1 chacun, pour mémoire.

La situation pour l'exercice écoulé, comportant ces modifications, vous sera présentée tout à l'heure par votre Trésorier, qui vous soumettra également le Budget pour 1937.

Aux termes de l'Article 13 des Statuts, les membres sortants de votre

Conseil cette année sont les suivants: S.E. Fouad Abaza Pacha, Messieurs le Professeur Dr. H. Priesner, Richard Wilkinson, Abdel Megid el Mistikawy. Ils sont rééligibles.

Vous aurez également à élire deux Censeurs.

Signé: A. Alfieri.

Rapport du Trésorier :

Situation au 31 Décembre 1936

Doit — **Avoir**

	L.E.	MM.		L.E.	MM.
Compte Bâtiment	14750	750	Compte Réserve Générale	41865	312
» Mobilier	7968	510	» Subvention du Gouvernement	497	000
» Bibliothèque	1820	521	» Coupons	729	753
» Collections	976	090	» Intérêts	49	905
» Laboratoire	542	122	» Cotisations	58	943
» Portefeuille	13747	545	» Diplômes	0	600
» National Bank of Egypt.	2071	869	» Vente Publications	9	770
» Cie du Gaz	4	629	» Suspens	1	000
» Appointements	843	750			
» Publications	294	144			
» Frais Généraux	154	333			
» Impôts et Assurances	38	020			
	43212	283		43212	283

Inventaire

Actif — **Passif**

Bâtiment pour mémoire	1	000	Réserve Générale	15829	043
Mobilier » »	1	000			
Bibliothèque » »	1	000			
Collections » »	1	000			
Laboratoire » »	1	000			
Portefeuille	13747	545			
National Bank of Egypt	2071	869			
Cie du Gaz	4	629			
	15829	043		15829	043

Le Portefeuille Titres en dépôt à la National Bank of Egypt se décompose comme suit :

156 Obligations Héliopolis 5 %.
9020 £ Dette Unifiée Egyptienne 4 %.
6700 £ Dette Privilégiée Egyptienne 3 ½ %.

Prévisions Budgétaires pour l'année 1937

Recettes

	L.E.	MM.
Subvention du Gouvernement Egyptien	497	000
Coupons	725	000
Cotisations	60	000
Intérêts	40	000
Vente Publications	5	000
	1327	000

Dépenses

	L.E.	MM.
Publications	230	000
Planches Mémoire Efflatoun Bey	150	000
Appointements	843	000
Frais Généraux	160	000
Impôts	30	000
Assurances	26	000
Abonnements Bibliothèque	20	000
Entretien Bâtiment	15	000
Imprévus	3	000
	1477*	000

* Par décision du Conseil d'Administration une somme de L.Eg. 150 sera prélevée de la Réserve pour combler le déficit résultant de l'éxécution des planches en couleurs destinées à illustrer le prochain Mémoire de Monsieur le Professeur H. C. Efflatoun Bey.

Signé : R. Wilkinson.

Rapport des Censeurs :

En conformité du mandat que vous avez bien voulu nous confier, nous avons l'honneur de porter à votre connaissance que nous avons procédé à la vérification du Bilan des Comptes de la Société Royale Entomologique d'Egypte arrêtés au 31 Décembre 1936, qui vous est présenté par votre Conseil d'Administration, ainsi que des pièces y afférentes, dont nous avons reconnu la parfaite concordance avec les écritures de la Société et en indiquant clairement la situation.

Signé : Dr. A. Azadian et E. Kaourk.
Le Caire, le 10 Février 1937.

Décisions :

L'Assemblée Générale approuve les Rapports du Secrétaire Général, du Trésorier et des Censeurs et donne au Conseil décharge de sa gestion pour l'exercice écoulé.

Elections :

S.E. Fouad Abaza Pacha, Messieurs le Professeur Docteur H. Priesner, Richard Wilkinson et Abdel Megid El Mistikawy, membres du Conseil sortants, sont réélus à l'unanimité.

Messieurs le Dr. A. Azadian et E. Kaourk sont réélus aux fonctions de Censeurs des Comptes de la Société.

Séance du 19 Avril 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Dons à la Bibliothèque :

La Société a reçu les ouvrages qui suivent :

1° De Monsieur A. Hustache, de Lagny (France) : 9 separata de ses récents travaux sur les Rhynchophores (coléoptères curculionides).

2° De Monsieur A. d'Orchymont, de Bruxelles : 5 tirés à part de ses publications sur les coléoptères palpicornes.

3° De Monsieur A. Alfieri : un exemplaire du Volume Jubilaire de Monsieur Eugène Louis Bouvier, édité à Paris en 1936.

Le Conseil remercie.

Echanges :

La Bibliothèque du Département d'Entomologie, Musée de l'Université, Oxford, se fait inscrire pour l'échange de nos publications contre les « Hope Reports », avec effet rétroactif à partir de l'année 1908.

Nomination :

Sur la proposition de Messieurs le Professeur H. C. Efflatoun Bey et A. Alfieri, Monsieur le Docteur-Ingénieur H. Koeber est admis à faire partie de la Société en qualité de membre titulaire.

Démissions :

Messieurs Aldo Mortera, du Caire, et Umberto Soleri, font parvenir leur démission.

Elections :

Les votes relatifs à la constitution du Bureau du Conseil et du Comité Scientifique pour l'exercice 1937-1938 donnent les résultats ci-dessous :

Sont élus : Monsieur le Professeur Docteur H. Priesner et Monsieur le Profseseur H. C. Efflatoun Bey, *Vice-Présidents;* Monsieur Anastase Alfieri, *Secrétaire Général;* Monsieur Richard Wilkinson, *Trésorier.*

Sont élus membres du Comité Scientifique : Messieurs le Professeur Docteur H. Priesner, Professeur, H. C. Efflatoun Bey, Docteur Kamel Mansour et Anastase Alfieri.

On the "Sugar Cane Thrips" *Podothrips lucasseni* (Krüg.), and some allied species

(Thysanoptera)

(with Text-Figures 1-13)

by H. Priesner

1. Podothrips (Kentronothrips) lucasseni (Krüger)

(Figs 1-2)

1890, *Phloeothrips lucasseni* Krüger, Ber. Vers.-Stat. Zuckerr., West Java, H. 1, p. 105.
1892, *Phloeothrips lucasseni* Kobus, Meded. Proefstat. Oost-Java, No. 43, p. 183.
1897, *Phloeothrips lucasseni* Zehntner, Arch. v. d. Java-Suikerindustrie, Jgg. 5, H. 1, Meded. Proefstat. Oost-Java, N. Ser. No. 37, p. 569.
1899, *Phloeothrips lucasseni* Krüger, « Zuckerrohr », p. 394, figs.
1906, *Phloeothrips lucasseni* Van Deventer, Handboek Suik.-Cult. Rietsuilk.-Fabr. Java, II, p. 282, Pl. 38, fig. 4.
1912, *Phloeothrips lucasseni* Karny, Zool. Annal., p. 324.
1912, *Phloeothrips lucasseni* Van Deventer, Handb. Suikerriet, p. 292, pl. 39, fig. 4
1923, *Phloeothrips lucasseni* Priesner, Tijdschr. v. Entomol., p. 104.
1927, *Phloeothrips lucasseni* Hood, Pan Pacific Entomologist, III, 4, p. 176.
1927, *Phloeothrips lucasseni* Hood, Entomologist, LX, foot-note, p.
1928. *Kentronothrips hawaiiensis* Moulton, Proc/ Haw. Ent. Soc., VII, 1, p. 126, pl. I, figs. 4 and 5
1930?, *Podothrips lucasseni* Karny (in schedis).

Krüger's description :

« *Phloeothrips lucasseni* nov.spec. — ♂ und ♀ ziemlich gleichgestaltet, ersteres etwas kleiner. Körper dunkel schwarzbraun, allein Fühler, Fussglieder und Unterschenkel der Vorderfüsse gelb-gelbbraun. Vorderschenkel mit einem Zahn. Flügel glashell, zart, lang und dicht bewimpert, lanzettspatelförmig, nur bis zum 5. oder 6. Hinterleibsringe reichend, beide Flügelpaare gleichlang. Ohne Punktaugen. Netzaugen schwarz. Fühler 8-gliederig, Glieder mehr oder weniger abgerundet, eiförmig. Hinterleib 9-ringelig, röhrenförmig Zugespitzt, schlank, am Endrande mit einem Kranz von 6-10 Borsten. 1-1,6 mm. lang und 0,18 bis 0,24 mm. breit am zweiten Körperringe. Larve : spitzer als bei *Thrips sacchari*, blutrot gefleckt ».

Though this description is just sufficient to recognize in Krüger's *Phloeothrips lucasseni* a Phlaeothripid, the figures and the later descriptions

and figures on the same species, given by Van Deventer (l.c., pl. 39, fig. 4) [1] leave no doubt that this insect is identical with what I possess (through the Buitenzorg Museum) from Pasoeroean, Java, collected by Dammerman from « Suikerriet ».

Van Deventer's remarks (pp. 292-293, l.c.) on the long head, the antennae being yellow (except joints 1,2 and 8), and the wings being narrowed in the middle, the fore femora enlarged, all the tibiae pale (« *licht* bruin ») and the tarsi having a distinct tooth [2], agree with the specimens from Java. The shape of the head, as indicated in fig. 4 (l.c.) is very characteristic for this species.

In 1912, Karny already dealt with this insect (Zool. Annal., p. 324) ; according to Krüger's : « Vorderschenkel mit einem Zahn », Karny mentioned that it might belong to the genus *Acanthothrips* Uz. (*Hoplothrips* auct. olim), but not having seen any sugar cane Phlaeothripids at that time, he was unable to make further remarks on this insect.

In 1927 (Pan Pacific Entomologist, III, 4, p. 176), Hood listed *Phloeothrips lucasseni* as a possible synonym of *Karnyothrips flavipes* (Jones), obviously owing to some similarity of this cosmopolitan species with the figure given by Van Deventer. In a foot-note of his paper « On Blood-Sucking Thrips » (Entomologist, LX, 1927), Hood makes a similar remark.

On the base of the material at hand, however, there is no doubt that « *Phloeothrips lucasseni* » of Krüger, Kobus and Van Deventer is quite different from *Karnyothrips flavipes*. That Karny shares my opinion on this point is shown by a pencil-note in Karny's own hand-writing on one of the slides, i.e. : « cf. *Podothrips, Glenothrips — lucasseni* ».

Moulton's *Kentronothrips hawaiiensis* is obviously the same insect. He gave it generic rank because of the elongate head and the hump on the fore femora, both characters distinguishing it from the type species of *Podothrips*. I think however that after the discovery of two further species which are humpless, viz. *P. graminis* nov.spec. and *P. oryzae* nov.spec., described below, and which are *very similar* to *lucasseni*, *Kentronothrips* has no more than subgeneric rank.

Moulton was first in giving a good description of *lucasseni*, which may be completed by the following one.

Female : Brown to blackish, joints 1 and 2 of the antennae dark, 2 paler at apex, joints 3-7 pale yellow, 7 slightly shaded apically, 8 brownish ; all tibiae and tarsi pale yellow, the extreme base of the middle and hind tibiae may be shaded, bristles rather light, anals dark basally ; wings clear.

Head longish, cheeks distinctly converging posteriorly, slightly convex ;

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(1) For true copies of this and other papers I am indebted to my friend Prof. Dr. H. H. Karny (Graz).

(2) The small tibial tooth naturally was overlooked.

head length, 248 μ (total 284), breadth across cheeks 172-175 μ; eyes not protruding, lateral length 76, dorsal 86 μ; head with an indistinct constriction behind eyes; inner distance of hind ocelli 46-48 μ, hind ocelli on a level with the anterior third of the eyes, front ocellus situated *on* the interantennal projection, between the first antennal joints; a small seta and nearby a bristleless pore in front of the hind ocellus, a sometimes somewhat larger microseta

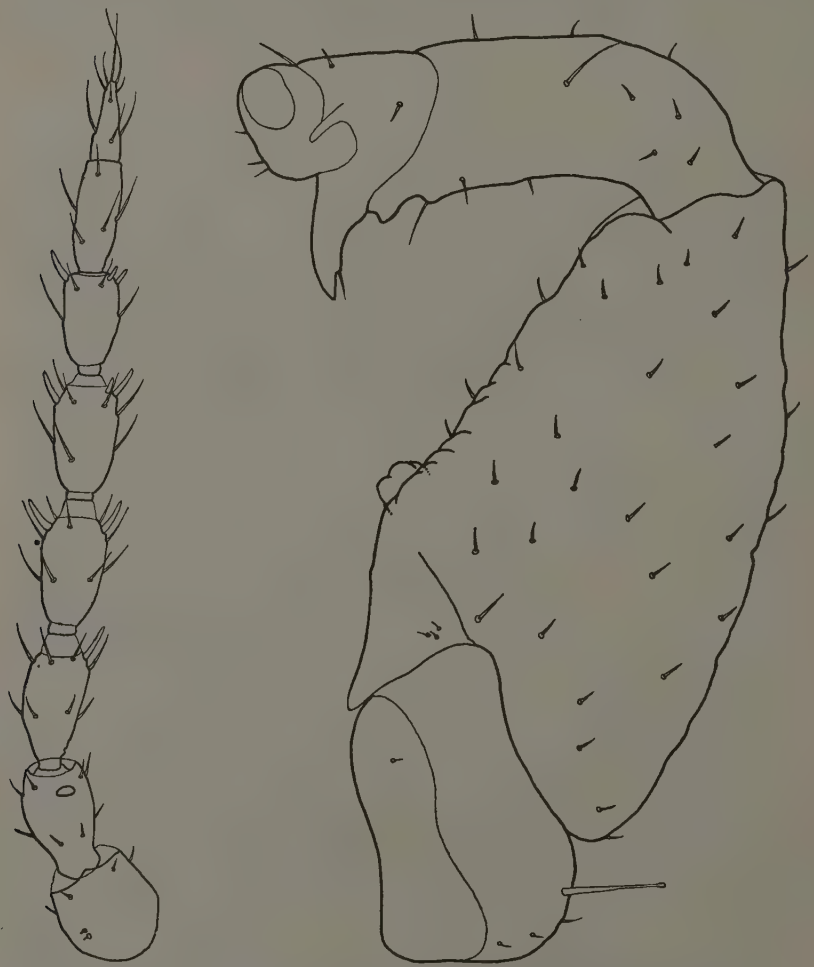


Fig. 1. — *Podothrips lucasseni* (Krüger): Antenna of female.
Fig. 2. — *Podothrips lucasseni* (Krüger) : Fore leg of female.

behind ; postoculars near the sides of the head, about 25 μ distant from the eyes, length 60-65 μ, at least rounded at apex or slightly dilated ; mouth-cone very short, rounded ; antennae length 345-390 μ ; measurements of joints, 42(b.42, t.35), 50-53(1), 53(28), 52(29), 50-52(28), 45(25), 48-49(20), 38-39(11) μ ; joint 1 narrowed toward apex, with the dorsal, apical tooth-like projection rather distinct, joint 2 normal, 3 asymmetrical, with inner margin distinctly convex, and with only the exterior sense-cone present, 4 with 1+1 sense-cones, 5 and 6 with $1+1+^1$ (the two exterior on 6 very small), 7 without sense-cone ; joints 7 and 8 slender, the latter not constricted basally. Pronotum with fore margin rather straight, hind margin much convex, length 220, width without coxae 260 μ ; antero-angular bristles well developed, 32-40 μ, almost sharp, two pairs of micro-setae (far apart from each other) on fore margin within ; laterals very small ; exterior postero-angulars 52-56 μ, knobbed, interiors 60-64 μ, pointed or nearly so ; fore femora enlarged, with a more or less developed hump-like projection at base within, interior surface of fore femora somewhat rugose (cross-wrinkles) ; fore tibiae with a small, pale triangular tooth apically ; tarsi with a long, sharp tooth, bearing a bristle before apex ; middle and hind tarsi not very slender ; pterothorax almost parallel-sided, width about 310, length 363 μ ; reticulation on middle of metanotum little noticeable, wings very narrow, constricted in the middle, with b.1 of the basal wing bristles very small, b.2 and 3 normal, 2 *slightly knobbed*, ab. 28, 3 pointed, 28-32 μ, their distance 20-25 μ ; double fringe wanting. Central portion of tergite 1 indistinctly reticulated, triangular, rounded in front, with a pair of bristle-less pores near hind margin ; tergite 2 with a pair of micro-setae but without pores ; tergites 3 to 8 with pores and micro-setae, the former close to each other on the anterior segments, far apart on tergites 8 and 9 ; bristles on tergite 9 hair-like, long (b.2 ab. 180 μ), pointed ; rod inside segment 9 conspicuous ; tube length 165 (dorsally) to 180 (laterally), basal portion somewhat thickened, width across base 72, at apex 36 μ ; anal hairs long, the lateral ones ab. 200 μ.

Male : The male is smaller and is either of the gynaecoid or the oedymerous type ; in the former, the fore femora may be even more slender than in the female, and b.2 of tergite 9 is about only 35-40 μ in length but not stouter than the other bristles of this segment ; in the oedymerous form, the fore femora are greatly enlarged, the fore tibiae also thickened, and strongly produced within, and along the inner margin of the fore tarsal tooth, the tibial tooth is attached to it, accompanying it up to half of its length and thereby somewhat obliterated as a separate projection ; in all males, the antennal joint 7 is dark at least in distal half, and sometimes joint 6 shaded at apical margin. Penis dilated at apex, and somewhat tripartite.

Measurements in μ : Head length, 225 (total 248), breadth 154 ; eyes (laterally) 76 ; antennae length 372 ; joints. 34-36(b.39, t.31), 48(27), 53(25), 49-50(28), 50(25), 45(21), 46(17), 38(11) ; pronotum length, 288,

width without coxae, 240-250; fore femora length (outer margin) ab. 260; pterothorax width, 260; tube length 152, width across base, 64, at apex, 32; bristle 2 of segment 9, 56-64, b.3, 188-192.

Habitat : The specimens on which the description is based were taken by Dr. Dammerman under leaf-sheaths of sugar-cane, on 12.VIII.1922, at Pasoeroean, Java. This species may be distributed all over the far eastern countries where sugar-cane is grown. Unfortunately, I do not possess the early stages.

Podothrips (Melampodothrips nov.) oryzae spec.nov.

« Black Paddy Thrips »

(Figs 3-6)

Very similar to *P. lucasseni* but differing by the wanting armature of the fore femora, and the somewhat more distinct crenulation of their inner margin, the more slender head, and by having both pairs of postero-angular prothoracic bristles knobbed instead of one only (the exterior) in *lucasseni*. Coloration as in the former species.

Female : Head (of holotype) 236 (incl. interantennal projection 260 μ), width across cheeks 160 μ, eyes (lateral) length 72; ocelli, bristles and microsetae as in the former species; length of postocular bristles — which are knobbed — ab. 56 μ; the antennae do not show any significant difference from those of *lucasseni*, except that they seem to be somewhat less slender, length 363 μ; measurements of antennal joints, 36(b.39,t.30), 45-48(28), 46(27), 45(28), 49-50(27), 42-43(25), 45-46(21), 32-34(12) μ; sense-cones about as in *lucasseni;* fore femora somewhat less enlarged than in the former species, *without hump-like process* at their base but with somewhat more conspicuous cross-wrinkles at the spot where the hump is situated in the other species, and with more distinct granulation on the inner surface of the fore femora; the small apical tibial tooth may be usually somewhat sharper and the tarsal tooth a little more slender. Shape of pronotum as in *lucasseni*, length 200-205, width without coxae, 240-250 μ; antero-angular bristles 36-44 μ, well developed, pale as all the others, exterior postero-angulars 44-48 μ, distinctly knobbed, interiors 52-60 μ, knobbed; coxals 40-45, knobbed; width of pterothorax ab. 295 μ; wings as in *lucasseni*, with basal wing bristle 2 distinctly dilated (measurements, 12-14, 40 and 24 μ). Tergite 1 about as in *lucasseni*, but with reticulation less distinct; tergite 2 without bristle-free pores (in one case of many, there is 1 pore visible); also the following segments in their chaetotaxy similar to that of *lucasseni;* b.1,2 on segment 9 ab. 144 μ in length; tube length (dorsally) 136 to (laterally) 144 μ, width across base ab. 63, across tip 31 μ; anal hairs ab. 188 μ.

Male : As the female, antennae somewhat more slender, fore legs some-

what more strongly enlarged in the œdymerous form, fore tarsal tooth longer, always distinctly separated from tooth of fore tibiae (in *lucasseni* there being a fusion of the latter with the tooth of the tarsus). There is a slight convexity at the base of the fore femora but no hump-like projection; antennal

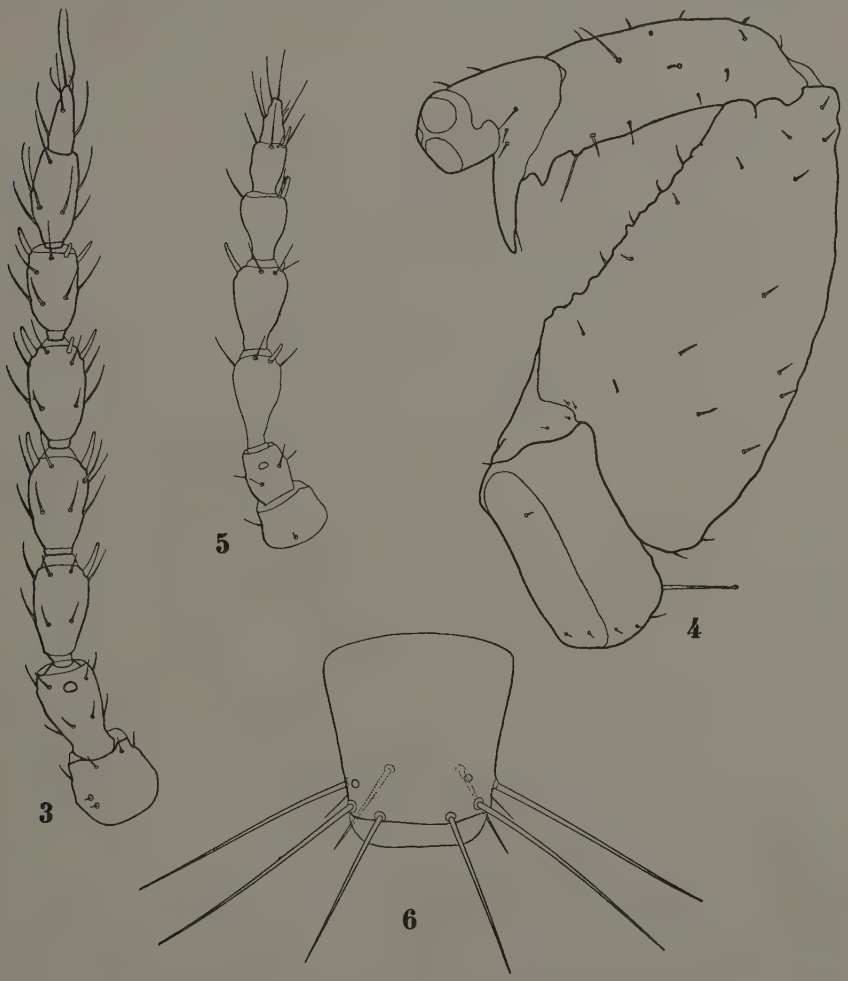


Fig. 3. — *Podothrips oryzae* spec. nov.: Antenna of female.
Fig. 4. — *Podothrips oryzae* spec. nov.: Fore leg of female.
Fig. 5. — *Podothrips oryzae* spec. nov.: Antenna of larva, second stage.
Fig. 6. — *Podothrips oryzae* spec. nov.: Ninth abdominal segment of larva, second stage.

joints 7 and 8 dark. — Measurements in μ : Head length, 212-216, width 146; antennae length 345-355; joints, 34(b.35,t.28), 48(25), 46-48(24), 49(25), 50(24), 42(21), 46(19), 31-32(11); pronotum length 190, width without coxae 234-243; pterothorax length 295, width 277; tube length 124 (lat. 128), width across base 59, at apex 32; bristles on segment 9, b.1 ab. 140, b.2: 48-52, b.3: 176.

Larva

I. Stage. — Female (four-bristle-type). Pale yellow, in full grown specimens perhaps with some red pigment cells as in the following stage; joints 1-4 of the antennae almost colourless, 5-7 greyish, terminal portion of abdominal segment 9, and all of segments 10 and 11 grey.

Shape slender. Width of head across eyes 72; interior eye bristle 11, postoculars 25-27, knobbed as the former; antennae length 180 μ; antennal joints, 14(29), 25(21), 25(24), 28(26), 22(24), 22(18), 28(10) μ; sense-cone on joint 4 thin, 13-14 μ in length; bristle 6 of the pronotum knobbed, the remaining bristles shorter, pointed, b.5 about 17, b.4: 11 μ; bristles 1 and 2 of the abdominal segments knobbed, b.3 pointed; b.3 on segment 7 ab. 73, b. 1 on segment 8: 14, b.2: 34, b.3: 50 μ; length of segment 9 ab. 45 μ; basal width 67, apical width ab. 50 μ; bristles on segment 9 hair-like, b.1 at least 64 μ, b.2 much longer, ab. 120 μ; length of segment 10 ab. 45 μ, basal width 36, apical width 17 μ; anal hairs very long, ab. 225 μ.

II. Stage. — Pale yellow, with reddish pigment cells in fresh specimens, probably forming a band all along the sides of the thorax and abdomen; shaded with pale grey are: the head between the eyes, the cheeks, joint 1 of the antennae and basal half of joint 2, the pronotal plates, the small bristle-bearing plates of the thorax, a lateral plate on segment 8, united with the small plate of bristle 1 of this segment, and the major part of the legs; dark grey are: joints 4-7 of the antennae (4 being somewhat paler than the following joints), the distal portion of abdominal segment 9 (the basal part pale grey, fading into pale yellow), and the whole of segments 10 and 11; anal bristles dark at base.

Head breadth across eyes 92, interantennal width 14 μ; cephalic bristles knobbed, anterior 20-24, postocular 32-40, lateral (more forward) pointed, 8 μ; antennae length 215-220 μ; measurements of joints, 20(b.32), 25(21), 42(22), 39-41(24), 32(21), 25(15), 20-21(10) μ; sense-cones on joint 4 almost straight, 13 μ; joint 7 separated from 6, though 7 rather broad at base; bristle 1 and 2 of the pronotum very small, b.3 about 16, probably with blunt tip, b.4 not more than 14 μ, perhaps pointed, b.5: 36 μ, decidedly knobbed; b.6 knobbed to nearly funnel-shaped at tip, 44-48 μ, b.7 pointed, 10 μ; on the mesonotum, the bristles of transversal row 1 are small, b.3 knobbed, ab.16 μ, b.6 (second row) is about 40 μ, and b.5 hardly shorter;

b.1 on abdominal segment 1 : 22, b.2 : 26-28 ; b. 3 of segment 7 knobbed, 48-52 μ ; segment 9 ab. 80 μ in length, 95 μ in width at base and 76 μ at apex ; segment 10, length 65 μ, basal width 52, apical w. 24 μ ; *bristles on segment 9 long, pointed*, b.1 ab.85, b.2,3 ab. 132-136 μ, b. 4 much shorter ; terminal hairs (segment 11) 200 μ or more.

This larva is similar in general appearance to those of *Haplothrips*, though not so much as is the larva of *Podothrips aegyptiacus* which is very close to that of *Haplothrips flavicinctus* (Karny) ; from the larva of *P. aegyptiacus*, that of *P. oryzae* is easily separated by the shorter antennae, the much less slender joints 7 and 8, and also by the simple (not forked or knobbed) setae of segment 9 of the abdomen.

Habitat : This species is from amongst Karny's unidentified material from Siam, bearing the following label : « Ladell, Bangkok, Siam, Paddy Thrips. Pot culture house B.A.S. July 27th, 1927, found under sheath leaf of paddy. Not causing much damage. Adults black. Youngest faintly yellow to translucent. Then red banded and others all red with transparent head ».

The latter are probably the pupae which now — having been kept a long time in alcohol — are quite pale.

A single male specimen carries the label : Java, Buitenzorg, 25.IX.1922, « angeflogen », leg. Karny.

A third species of this group, which at first I thought identical with the former, is

Podothrips (Melampodothrips) graminum spec.nov.,
(Figs 7-11)

differing from *P. oryzae* chiefly by the presence of two small sense-cones on antennal joint 3, instead of one, by the anterior postero-angular bristles of the pronotum, which are pointed, by the almost entirely dark fore femora, and the almost wholly pale joint 7 of the antennae.

Female : Blackish to brownish black, with all tibiae and tarsi and joints 3-7 of the antennae pale lemon-yellow ; joint 7 is sometimes slightly shaded at extreme apex, and the middle and hind tibiae are slightly darkened at extreme base ; wings clear ; joint 2 of the antennae paler apically at the outer angle, sometimes up to half its length ; thorax dotted with crimson pigment cells, abdomen with two narrow lateral bands of light crimson pigment cells ; bristles pale, except the base of the anals.

Head distinctly more elongate than in the rice-*Podothrips*, length from eyes 268 (total 296) μ, breadth about middle 170 μ, eyes length (lateral) 72-76 μ ; ocelli, bristles and micro-setae as in the former species ; length of postocular setae, which are pointed, 64-72 μ ; distance of hind ocelli (in holotype) 42 μ, distance of postoculars 138 μ ; antennae, length ab. 398 μ, some-

what more slender than in *oryzae;* measurements of joints, in holotype : 39(b.42,t.31), 50(29), 53-56(27), 56(31), 59(29), 50(25), 50(21), 38(13) μ; joint 3 with inner surface evenly convex, whilst its outer surface is straight up to the middle of the joint; two small, fine sense-cones are developed, the outer somewhat larger than the inner; joint 4 with 1+1 sense-cones, 5 with $1+1+^{1}$, 6

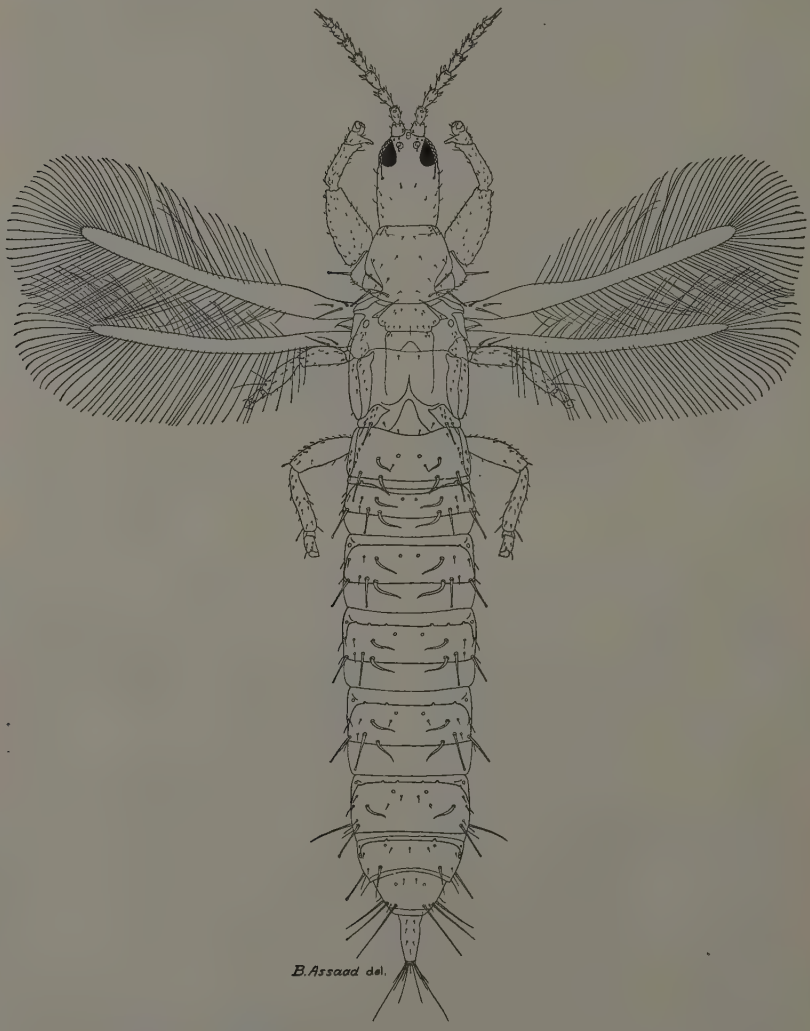


Fig. 7. — *Podothrips graminum* spec. nov.: Female.

with 1+1+[1], 7 without sense-cone ; joint 8 slightly constricted at base ; fore femora about as in *oryzae*, without hump-like process at base but with the granulation at the inner surface somewhat finer than in *oryzae ;* fore tibiae and tarsi

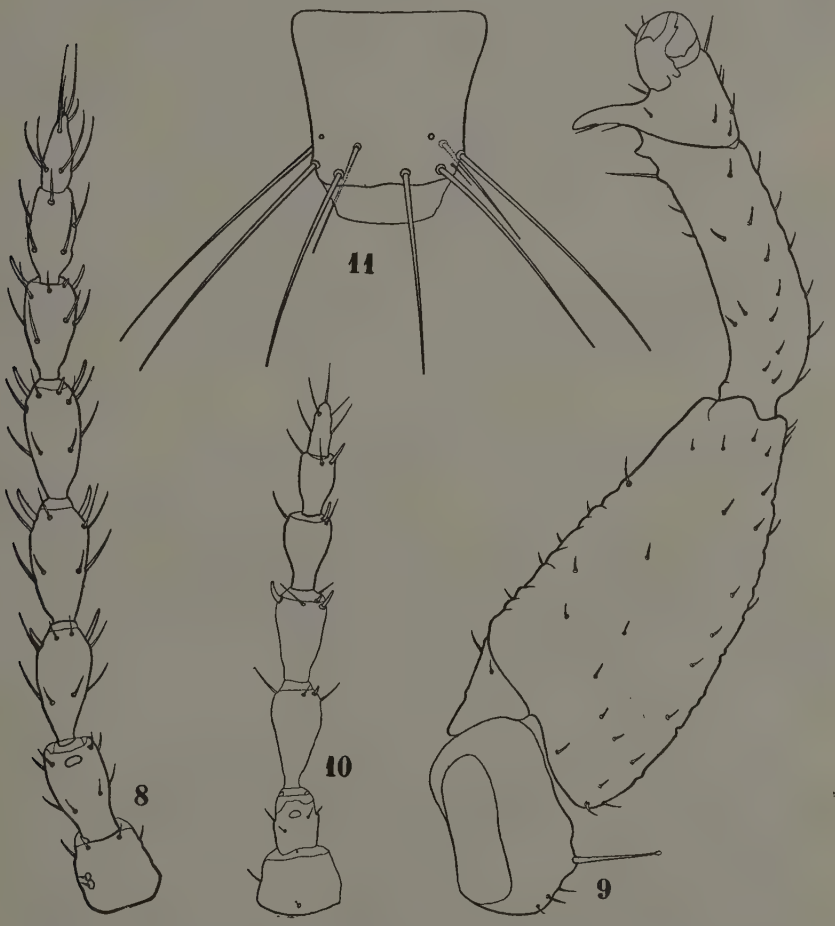


Fig. 8. — *Podothrips graminum* spec. nov. : Antenna of female.
Fig. 9. — *Podothrips graminum* spec. nov. : Fore leg of female.
Fig. 10. — *Podothrips graminum* spec. nov. : Antenna of larva, second stage.
Fig. 11. — *Podothrips graminum* spec. nov. : Ninth abdominal segment of larva, second stage.

about as in *oryzae ;* prothorax length 200, width without coxae 242-260 μ ; antero-angular bristles pointed, ab. 40 μ, *interior postero-angulars pointed,*

ab. 60 μ, exteriors knobbed, 56-60 μ; coxals 52-56, knobbed. Pterothorax width 240-303 μ; basal wing bristles somewhat varying in length, 18, 40-44, 32 μ in holotype, all pointed, their distances 28 and 14 μ respectively. Median plate of abdominal segment 1 with its sides concave; tergites 2-9 with a pair of pores in front of the micro-setae; these pores are close to each other on tergites 2-6, more widely separated on tergites 7-9; bristles on segment 9 long, fine, hair-like, colourless as all the others, b.1 more than 160 μ, b.2 ab. 220, b.3: 108-124 μ; tube as in *oryzae*, length 152-156, width at base 74 μ, at apex 34 μ; anal hairs length 200 μ.

Male: Differing from the female as in *oryzae*, particularly in having b. 2 of the bristles of tergite 9 short and stout (52 μ), b.2 ab. 172, b.3 ab. 120 μ. Further measurements of allotype, in μ: Head length 208 (total 230), width 138; antennae length 337 joints, 25-31 b. 32, t. 25), 42(24), 45(22), 48-50(24), 48(24), 45(20), 43(19), 35(13); pronotum length 156, width without coxae 190-200; pterothorax width 225, length 260 μ; tube length 120-125 (dorsally) to 128 (laterally), width across base 56, across apex 28.

Larva

I. Stage. — Not yet available for description.

II. Stage. — Easily separable from the same stage of the larva of *P. oryzae* by the somewhat narrower head, the distinctly more slender antennae, the pointed cephalic bristles, and the pointed bristle 5 of the pronotum.

Fresh specimens are rather vividly coloured, having on a pale yellow ground, a more or less broad lateral streak of red pigment cells at the sides of the meso- and metathorax, and more or less large red spots about the hind angles of the abdominal segments 1 (or 2)-9 (or 10); these spots may — if richly developed — be dorsally united at the hind margins of the segments; head, prothorax and appendages without red pigment, joints 1 and 3 of the antennae usually pale whitish, 2 shaded with pale grey at the basal two-thirds, joints 4-7 blackish brown, 4 somewhat lighter than the following joints; abdominal segment 9 shaded with grey except at base where it remains almost colourless, sometimes up to half of the length of the segment; segments 10 and 11 entirely dark.

Head breadth across eyes 96, interantennal distance 14 μ; inner eye bristle ab. 22, postocular b. 40, lateral 11 μ, *all pointed;* antennae length 225-243 μ; measurements of joints, 20(29), 28(20), 45(20), 49(23), 35(22), 28(15), 24(9) μ; sense-cone on joint 4: 11-13 μ; bristles 1 and 2 of the pronotum exceedingly small, b. 3 ab. 18 μ, pointed, as well as b. 4 and 5, the former ab. 14, the latter 32-35 μ; *b.6 knobbed*, 48 μ, b.7 small, 10-11 μ; b.5 of the bristles on mesonotum pointed, ab. 39 μ, b.6 knobbed, 36 μ; also on metanotum only one pair of bristles knobbed; on segment 1 of the abdomen, b.1 pointed, 20 μ, b.2 knobbed, 28 μ; on segment 7 and 8, b.1 pointed, b.2 and 3 knobbed; b.1 on segment 8: 40, b.2: 52, b.3: 56 μ; length of segment

9 ab. 86 μ, basal width 88-96, apical width 72-76 μ; segment 10, length 66 μ, basal width 48, apical width 22 μ; b.1 and 2 of segment 9: 100-105, b.3: 136 μ, pointed; anal hairs about 200 μ.

Habitat: Egypt. — I received this species in great numbers from Barqîn and Fârûkîya, where it was found (IV.-VI.) in mixed turf material, mainly consisting of Gramineae, particularly « negeel » (*Cynodon dactylon*); the species lives no doubt under the leaf-sheaths of Gramineae.

Podothrips (Podothrips) aegyptiacus Pr.

1929. Bull. Soc. R. Ent. d'Egypte, p. 59, figs. 1-3.

(Figs. 12-13)

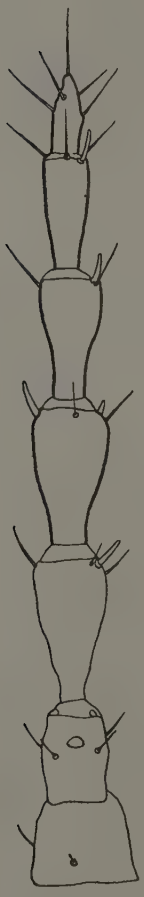
Larva

I. Stage. — The specimens before me are not very well mounted but show that they are quite different from the same stage of the *Melampodothrips* group, e.g. *Podothrips oryzae;* antennal joints 1-3 pale, joints 4-7 dark grey, 4 somewhat lighter than the following joints; measurements of antennal joints, 28(24), 28(28), 32-34(28), 28(22), 31(17), 35-36(9) μ; total length 200-208 μ; sense-cone on joint 4: 13 μ; b. 6 of pronotal bristles 30 μ; b.1 of those on segment 9 of the abdomen *knobbed*, at least 48 μ, b.2 pointed 112-120 μ; anals almost 320 μ.

II. Stage. — Stouter than any of the former species; coloration similar to that of *P. graminum* larva but the pigment cells fading into orange in the anterior parts of the body, with sometimes some streaks or spots of cells also in the pronotum, and with the meso- and metanotal pigment more spot-like and more abundant; joints 1-3 of the antennae wholly light (whitish-yellow), joints 4-7 blackish-brown; abdominal segments 10 and 11 brown, segment 9 only slightly shaded, particularly at the apical margin.

Head breadth across eyes 105, interantennal distance 18 μ; inner eye bristle blunt, 24 μ, postoculars about 28 μ, very slightly dilated at tip; antennae length 260-265 μ; measurements of joints, 22(32), 31-32(22), 48(24), 45(24-25), 41(20), 36(14), 25-27(8) μ; sense-cone on joint 4: 13-14 μ; bristles 5,6 and 7 of the pronotum knobbed, their lengths 32, 38 and 34 μ, respectively; b.3 well forward, distinct, slightly knobbed, 28 μ; b.1,2 and also 4 vestigial; b.6 of meso- and metanotum knobbed, almost funnel-shaped, 40-45 μ; b.2 on abdominal segment 1: 25 μ; all dorsal bristles on segment 7 and 8 knobbed, b.3 on sgm. 7: 80, bristles on sgm. 8: 36,52 and 68 μ; b.1 on segment 9 knobbed, 64-68, b.2 and 3 forked at tip, 68-72, b. 4 pointed, 80 μ; segment 9 about 68-72 μ in length, 124 μ wide at base, 84 μ at apex; segment 10: length 80, basal width 62, apical width 28 μ; lateral plates on segment 8 entire, emarginated to trifurcate at anterior margin; length of anal bristles at least 340 μ.

This larva is at once distinguished from that of *P. oryzae* and *P. graminum* by the antennae, being longer and much more slender, furthermore by



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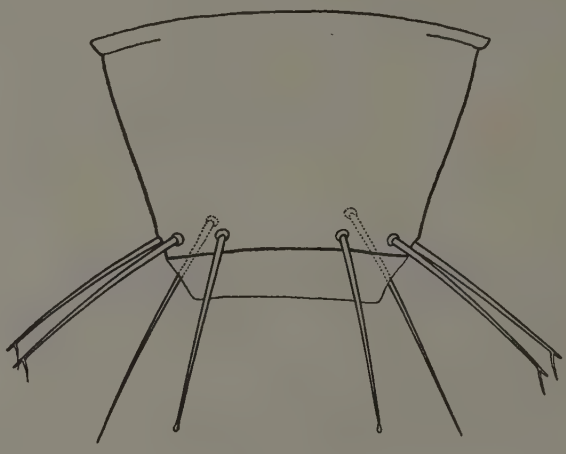

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Fig. 12. — *Podothrips aegyptiacus* Pr. : Antenna of larva, second stage.

Fig. 13. — *Podothrips aegyptiacus* Pr.: Ninth abdominal segment of larva, second stage.

the well developed b.7 of the prothorax, and the forked bristles 2 and 3 of the 9th abdominal segment.

Habitat : Egypt, Cyprus. — The species is widely distributed over Egypt where it is found under leaf-sheaths of larger Gramineae, especially of *Phragmites communis* Trin. ; the eggs are deposited at the base of the leaf-sheaths ; sometimes one meets several specimens and larvae under one leaf

but only when mealy bugs (*Ripersia phragmitis* Hall) are present, on which the thrips was actually seen feeding.

In 1929, l.c., p. 61, I have published a table on the species of the genus *Podothrips* Hood; in this key, *Podothrips denticeps* Hood (1916, Kamerun) was omitted by mistake; it has no duplicated cilia on the fore wings, and therefore comes near *xanthopus* Hood, but differs by having only the first abdominal segment pale lemon yellow, and joint 8 of the antennae dark; typical for the genus are the species *semiflavus* Hood (genotype) and *aegyptiacus* Pr.; *lucasseni* (Krüg.), *oryzae* and *graminum*, though very close to one another, are different from the genotype by their much more slender head; they ought to be sub-generically separated, and — for the moment — the following groups (sub-genera) may be introduced :

1 (2) Head only a little longer than wide. Body vividly coloured. .... (*Podothrips* s.str.)

2 (1) Head slender, much longer than broad. Body almost or wholly dark.

3 (4) Fore femora with a distinct hump at base within; no bristleless pores in the middle of tergite 2; joint 3 of the antennae with 1 sense-cone only (*Kentronothrips* Moult.) ..... *lucasseni* (Krüg.)

4 (3) Fore femora without a hump at base. . (*Melampodothrips* nov.)

5 (6) Joint 3 with only 1 sense-cone; both postero-angular prothoracic bristles knobbed; the larger (b.2) of the basal wing bristles and the postoculars knobbed: normally no bristleless pores on tergite 2: tip of fore femora yellowish; antennal joint 7 shaded .... *oryzae* Pr.

6 (5) Joint 3 with *two* small sense-cones; interior postero-angular prothoracic bristle pointed; all basal wing bristles and the postoculars knobbed; tergite 2 with a pair of pores in front of the pair of microsetae; fore femora uniformly dark; antennal joint 7 yellowish, only joint 8 shaded ..... *graminum* Pr. (type subg.) (3)

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(3) Very close to *P. graminum* is the only recently described species *P. longiceps* Jacot-Guillarmod (Bull. Univ. Pretoria, N. Sci. 3, p. 16, pl. II, figs. 10, 12; p. 49.—1937) from South Africa; it is smaller, with its tibiae dark at base, and the antennal joint 7 so at apex, and has no micro-pores on tergite 2; it differs from *oryzae* by its smaller size, the wholly dark fore femora, and in having 2 sense-cones on joint 3 of the antennae.

A.M.L.

La lutte contre la courtilière à l'aide d'appâts empoisonnés

par Antoine Cassab

Les dégâts occasionnés par les courtilières avaient attiré l'attention du Ministère de l'Agriculture dès 1933, date à laquelle les cultures potagères et maraîchères commençaient à prendre une plus grande extension.

Pour répondre aux nombreuses plaintes reçues des cultivateurs qui voyaient leur plantation ravagée par les courtilières, le Ministère de l'Agriculture jugea nécessaire l'établissement, à Dokki (Gizeh), d'une station de recherches sur le problème gryllotalpien.

Cette station a entrepris de nombreuses expériences et les préparations à base de phosphure de zinc furent celles qui donnèrent les résultats les plus encourageants. Le Ministère conseilla donc cette méthode aux cultivateurs, leur indiquant, en même temps, le mode d'emploi et les précautions à prendre dans la manipulation.

Toutefois, le prix élevé (environ P.T. 18 le kg.) du phosphure de zinc fit tourner les recherches vers un remède plus à la portée des moyens limités du fellah

Le fluosilicate de baryum fut essayé et les résultats obtenus par son application démontrèrent qu'il est, tout au moins en ce qui concerne son emploi contre les courtilières, aussi efficace que le phosphure de zinc.

A l'avantage du prix moins élevé (environ P.T. 6 le kg.) il faut ajouter que le fluosilicate de baryum est d'un emploi bien plus facile que le phosphure de zinc dont la manipulation demande de sérieuses précautions.

La formule suivante est celle qui a été adoptée :

Maïs ou riz concassé	100 kilos
Phosphure de zinc ou fluosilicate de baryum	5 kilos
Eau	25 litres

L'eau est versée sur le maïs [1] ou le riz concassé. Dès que ces substances en sont bien imprégnées, le phosphure de zinc ou le fluosilicate de baryum y est ajouté, et le tout bien mélangé.

A la tombée du jour, le mélange ainsi obtenu est répandu, à la volée dans les cultures attaquées, à raison de 12 kilos au feddan.

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[1] La préférence a été donné au maïs vu son prix moins élevé.

Les pièges lumineux et la courtilière

par Antoine Cassab

En 1934, simultanément aux expériences entreprises à l'aide d'appâts empoisonnés, les pièges lumineux furent essayés dans la lutte contre la courtilière. Les pièges étaient constitués par des lampes portatives à acétylène. Ils furent placés dans les champs signalés fortement infestés, au nombre de trois, disposés l'un au centre (C) et les deux autres (L1 et L2) latéralement, à diverses époques de l'année, de 9.30 à 10.30 p.m. Des résultats obtenus, il peut être déduit :

1. — Les courtilières volent et sont attirées par la lumière.

2. — Les ♀♀, dont le poids est assez lourd, 2 gr. 670 (*Gryllotalpa gryllotalpa*) sont rarement capturées à la lumière, alors que les ♂♂, plus légers et dont le poids moyen de 2 gr. 010, viennent beaucoup plus nombreux.

A la saison des pontes (Mai-Juillet), les femelles pleines et dont le poids moyen est alors de 3 gr. 110, ne viennent jamais à la lumière. En effet, toutes les femelles capturées au cours de ces trois mois furent disséquées et trouvées vides d'œufs.

3. — Les courtilières sortent plus fréquemment à la surface du sol durant la saison chaude et sont attirées en nombre par les pièges lumineux. Par contre, à la saison froide elles se confinent dans leurs galeries et les captures sont assez rares.

4. — Les pièges placés au centre des champs infestés sont ceux qui donnent les meilleurs résultats.

5. — Il n'a été constaté aucun vol de la var. *eophta*. Sans doute cette forme brachyptère ne peut voler à cause de ses ailes relativement petites par rapport à son corps assez lourd.

En ce qui me concerne, j'ai examiné de nombreux spécimens capturés à la lumière des maisons, sans jamais constater la présence de la var. *cophta*.

6. — Vu ce qui précède et étant donné qu'en Egypte la var. *cophta*, la plus commune et la plus répandue des courtilières, n'est pas capturée par les pièges lumineux, il faut conclure que ceux-ci ne représentent pas un moyen efficace de lutte.

Le Tableau qui suit donne les détails des essais effectués.

TABLEAU DES CAPTURES DE COURTILIERES

DATE	LOCALITÉ	Superficie attaquée en feddans	GENRE DE CULTURE	Température en °C.	Humidité	Disposition des pièges	NOMBRE DES CAPTURES						Total des captures
							gryllotalpa		var. *cophta*		*africana*		
							♂	♀	♂	♀	♂	♀	
12. 1.34	Gharbieh	10	pomme de terre	18	59	L 1 C L 2	— — —	— — —	— — —	— — —	— — —	— — —	0
18. 2.34	Menoufieh	7	pomme de terre	19	61	L 1 C L 2	— — —	— — —	— — —	— — —	— — —	— — —	0
20. 3.34	Alexandrie	2	jardin	20	63	L 1 C L 2	— 2 —	— — —	— — —	— — —	— — —	— — —	2
12. 4.34	Ghizeh	12	pomme de terre	25	64	L 1 C L 2	— 1 —	— — —	— — —	— — —	— 1 1	— — —	3

DATE	LOCALITÉ	Superficie attaquée en feddans	GENRE DE CULTURE	Température en °C.	Humidité	Disposition des pièges	NOMBRE DES CAPTURES						Total des captures
							gryllotalpa		var. *cophta*		*africana*		
							♂	♀	♂	♀	♂	♀	
18. 4.34	Alexandrie	3	jardin	22	65	L 1 C L 2	— 2 1	— 1 —	— — —	— — —	— — —	— — —	4
25. 4.34	Fayoum	2	coton	29	52	L 1 C L 2	— — —	— — —	— — —	— — —	1 2 —	— — 1	4
17. 5.34	Calioubieh	5	pastèque	29	50	L 1 C L 2	1 2 —	— — —	— — —	— — —	— — —	— — —	3
29. 5.34	Beni-Souef	4	pastèque	31	48	L 1 C L 2	1 — 1	— — —	— — —	— — —	— 1 —	— — —	3
16. 6.34	Gharbieh	2	culture potagère (carotte, courgette, etc.)	30	50	L 1 C L 2	1 2 —	— 1 —	— — —	— — —	— — —	— — —	4

DATE	LOCALITÉ	Superficie attaquée en feddans	GENRE DE CULTURE	Température en °C.	Humidité	Disposition des pièges	NOMBRE DES CAPTURES						Total des captures
							gryllotalpa		var. *cophta*		*africana*		
							♂	♀	♂	♀	♂	♀	
22. 6.34	Fayoum	3	coton	34	46	L 1 C L 2	— — —	— — —	— — —	— — —	1 3 1	— — 1	6
10. 7.34	Dakahlieh	1	culture potagère	35	42	L 1 C L 2	1 2 1	— — —	— — —	— — —	— — —	— — —	4
18. 7.34	Ghizeh	2	culture potagère	34	55	L 1 C L 2	— 2 —	1 — —	— — —	— — —	1 — —	— — —	2
9. 8.34	Port-Saïd	2	jardin	30	63	L 1 C L 2	1 2 1	— — —	— — —	— — —	— — —	— — —	4
19. 8.34	Ghizeh	1	culture potagère	31	62	L 1 C L 2	1 1 1	— — —	— — —	— — —	1 — —	— — —	4

DATE	LOCALITÉ	Superficie attaquée en feddans	GENRE DE CULTURE	Température en °C	Humidité	Disposition des pièges	NOMBRE DES CAPTURES						Total des captures
							gryllotalpa		var. *cophta*		*africana*		
							♂	♀	♂	♀	♂	♀	
14. 9.34	Calioubieh	2	culture potagère	30	58	L 1 C L 2	— 1 1	— — —	— — —	— — —	— — —	— —	2
22. 9.34	Fayoum	1	culture potagère	31	55	L 1 C L 2	— — —	— — —	— — —	— — —	— 1 1	— — —	2
12.10.34	Ghizeh	11	pomme de terre	26	52	L 1 C L 2	— — —	— — —	— — —	— — —	— — —	— — —	0
15.11.34	Gharbieh	8	pomme de terre	20	48	L 1 C L 2	— — —	— — —	— — —	— — —	— — —	— — —	0
20.12.34	Ghizeh	15	pomme de terre	17	49	L 1 C L 2	— — —	— — —	— — —	— — —	— — —	— — —	0

Séance du 10 Mai 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Don d'ouvrages :

La Société a reçu pour sa Bibliothèque 48 tirés à part d'auteurs divers et relatifs à l'entomologie, offerts par Monsieur Anastase Alfieri.

The Physiology of Arthropodan Development with special reference to the Insects

(with 20 Text-Figures)

by N. S. R. Maloeuf,
Sterling Fellow in Animal Biology, Yale University.

(Contribution from the Zoological Laboratory, Cornell University, and the Osborn Memorial Laboratory, Yale University)

SECTION I

EMBRYONIC LIFE

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Summary.

« *The new material enters the aggregate.... in the form of food consumed by the existing organisms. Births and the preliminaries of procreation do not in themselves add anything to the aggregate, but are merely catalyzing influences.... guiding material into so many avenues of entrance (mouths)* .... » — A. J. Lotka.

« It was formerly believed », wrote Bladh (1772), « that insects were produced by equivocal generation, or from putrefaction, and that the putrified remains of other animals were changed into them ; and that infinite mixtures and varieties might thus arise without law or order. This absurd and futile opinion, almost universally prevailed until the times of Harvey and Rhedi, who, from uncontroverted experiments, proved that the same laws of propagation existed in those as in other animals and that *every living thing is produced from an egg* ». The period before William Harvey and Rhedi contrasts markedly with the present one in which splendid treatises exist on the descriptive embryology, developmental mechanics, and chemical changes occurring even prior to the time of fertilisation till the complete growth and differentiation of the embryo. We have far from attained the stage, however, of being able to correlate morphological changes, chemical changes, and genic constitution into a single continuum.

An embryo requires nourishment and energy and excretes nitrogenous wastes. This energy is obtained from hydrolysis and oxidation of the main potential sources of energy involved in the maintenance of life, namely, the carbohydrates, fats, and proteins. It should be remarked emphatically, how-

ever, that the processes of morphogenesis, or differentiation, consume no energy of their own but are merely the gross expressions of physico-chemical changes occurring within the organism. When still within the egg shell or when within the reproductive system of the female parent, an animal may be said to be in the embryonic, or pre-natal, stage of its life. Thus, a larval stage in one species may be embryonic in a corresponding stage of another species. In forms which possess free-living embryos, such as sea urchins, the larval period may be said to commence and the embryonic to cease when the organism becomes mobile (either by muscular or ciliary action) within its environment.

A. — Kinds of Eggs and Types of Segmentation

The eggs of many animals contain «yolk», or «vitellin», which acts as a nutritive reserve for the developing embryo. This is a phosphoprotein containing lecithin. Eggs may be classified according to the abundance and arrangement of the yolk since, in accordance with Balfour's rule (Balfour, 1875, 1880, p. 77), the rate of cleavage and size of the segments varies inversely with the concentration of yolk.

(1) *Alecithal or oligolecithal eggs* have no yolk or only a very slightly amount of such. In such cases, animals which do not develop within the body of the parent (e.g. in certain marine forms) do not have an extended embryonic period, for the animal must acquire nutritive materials from the exterior. While in most species of arthropods the egg is rich in yolk so that the embryo derives nourishment solely from such, the eggs of scorpions, such as *Scorpio* (Metschnikoff, 1870; Laurie, 1891) are small and alecithal and the young develop in sacs of the oviducts deriving nourishment from the tissues of the sacs. The young, in the latter case, are lain as such and not in egg cases and, since nourishment is derived from parent, the animals are ovoviviparous rather than, as mammals, viviparous.

The embryos of such eggs, except those of *Scorpio*, are holoblastic, i.e. the whole egg becomes a corporal part of the embryonic cells. The eggs of the decapod, *Lucifer* (Brooks, 1883), are very poor in yolk and undergo complete and equal cleavage.

(2) *Isolecithal eggs* have the yolk equally disposed throughout the egg cytoplasm, e.g. sea urchin and Collembola eggs. In such cases cleavage is holoblastic. Among the arthropods, holoblastic cleavage is comparatively rare and is exemplified by certain parasitic wasps (cf. Korschelt and Heider, 1899), Crustacea (van Beneden and Bessels, 1869; Hoek, 1876; Grobben, 1881; Urbanowich, 1884), and the copepod, *Cyclops viridis* (Jacobs, 1925).

(3) *Telolecithal eggs* have the yolk chiefly located at one end, known as the vegetal pole, there being a gradient in the concentration of the yolk globules from the vegetal to the animal pole. In frogs' eggs the differences in concentration of the yolk between the animal and vegetal poles are not as great as in the eggs of cephalopod molluscs, teleost fishes, reptiles, birds, and monotreme mammals. Thus, in the former, while cleavage is less rapid in the vegetal than the animal pole (Balfour's rule) the whole egg nevertheless undergoes cleavage, the yolk-containing cells being larger and supplying nutrition to the embryo. In the latter groups, polarity is so marked that the vegetal pole undergoes entirely no cleavage. Both types of telolecithal eggs, however, do not differ radically since centrifugation of the former will produce a similar condition as that which exists in the latter.

Embryos which develop out of inextreme telolecithal eggs are holoblastic, e.g. frogs, while those which develop out of extreme telolecithal eggs, e.g. reptiles and birds, are meroblastic, i.e. the embryo itself forms only part of the egg, the remainder of the egg consisting of nutritive material.

(4) *Centrolecithal eggs* have the yolk globules in the center and surrounded by a relatively narrow margin of yolk-less cytoplasm. Upon cleavage, the nuclei migrate to the peripheral margin of cytoplasm after which cell membranes delimit a portion of the cytoplasm to each nucleus. This peripheral layer of cells is known as the blastoderm. Embryos which develop out of centrolecithal eggs are quite evidently meroblastic. Centrolecithal eggs are characteristic of arthropods and are present in the majority of this great phylum.

There are two methods in the formation of the blastoderm among the Crustacea (cf. Korschelt and Heider, 1899). In the one, formation takes place all over the surface simultaneously, e.g. *Astacus*, *Branchipus*, and the free-living Copepoda. In the other, « the blastoderm develops first on the ventral side of the egg. Its formation begins at one point on the surface and proceeds gradually from this point. In the Decapoda the point denotes the most posterior end of the ventral side at which later the gastrula invagination appears ». In scorpions the blastodermal disc of cells forms at the pole of the egg which is directed from the follicle towards the ovarian tube. The blastoderm spreads gradually from this region of the yolk. In chilopods the development of the blastoderm is first completed on the ventral side of the egg from which it spreads later to the dorsal side. In insects, such as the beetle, *Hydrophilus* (Korschelt and Heider) and the honeybee (Schnetter, 1934) the nuclei migrate all over the ventral surface at an equal rate. Cells, known as « vitellophags », remain behind among the yolk globules and are supposed to hydrolyse the yolk into materials absorbable by the embryonic cells.

The nature of the forces bringing about the migration of the nuclei from among the yolk spherules to the periphery has not been determined, but

Wilson (1901) has produced an imitation of the process in the normally holoblastic embryo of the sea urchin, *Toxopneustes variegatus*, in a remarkable way. After fertilisation the egg was etherised. The nuclei divided but the cytoplasm failed to divide. « The nuclei then migrate towards the periphery (fig. 1) and arrange themselves at nearly equal intervals in a position nearly identical with which they would have had in a completely segmented egg... the egg might almost be regarded as an undivided blastula the cavity of which is suppressed... The egg thus gives rise to a syncytium containing

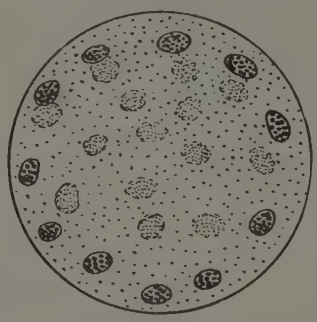

Fig. 1. — Embryo of the sea urchin, *Toxopneustes variegatus*, normally a holoblastic embryo, showing failure of cytoplasmic cleavage due to etherisation after fertilisation. The embryo thus gives rise to a peripheral syncytium of 8 to 64 nuclei. — (After Wilson).

from 8 to 64 nuclei in a manner which recalls in the most striking way the normal cleavage-forms of some of the coelenterates and arthropods ». Especial attention has been called to this experiment of Wilson because the sea urchin egg, by virtue of its thin outer membrane and transparency, offers an unusually favorable condition for investigating the factors involved in the migration of the nuclei to the periphery (1). The fact that the vitellophags of centro-lecithal eggs often move in an opposite direction to that of the blastoderm nuclei and, in fact, often do not move at all, is strongly indicative against any protoplasmic streaming causing the peripheral migration of the nuclei.

B. — Growth

There are various types of organismal growth, that is, there are different manners whereby an organism can increase in size. Growth is not solely a

(1) Loeb (1900) obtained similar results by using concentrated sea water. When returned to normal sea water such eggs divide into as many cells as there are preformed nuclei.

characteristic of living organisms but also occurs at inorganic levels, as in the trite example of the growth of a crystal in a supersaturated solution. In all cases, growth is « the increase of the mass of one component of a system at the expense of another. It is precisely the same as that which occupies the center of attention of the physical chemist, though he does not ordinarily call it growth. In fact he does not find it necessary to give it any particular name, for, being accustomed to the use of mathematical methods and symbols, he simply writes it dm/dt, rate of increase of mass with time, or more often $\frac{d}{mt}\left(\frac{m}{v}\right)$, rate of increase of concentration (mass/volume) with time » (Lotka). Davenport (1899) pointed out, however, that « organic growth is increase in volume. It is not development ; it is not differentiation ; it is not increase in mass, although the latter may often serve as a convenient measure of growth ». An illustration of increase in volume with, in fact, a decrease in mass is given during the post-embryonic growth of terrestrial insects. Thus, during the process of molting, many terrestrial insects swallow air and increase considerably in volume but not in mass when weighed in air, just as an air-inflated balloon will weigh just as much in air as the same balloon when deflated. When the old cuticle is shed, the mass of the insect is even less than before it had increased in volume and assumed the outward dimensions of a later instar. Yet who would maintain that the insect had not grown. In biology, therefore, growth may be measured by the rate of increase in volume, i.e. in size. Owing to the universal approximate identity of the specific gravity of protoplasm, increase in volume is, however, in most cases, a direct function of the increase in mass.

Immediately after a cell divides the two daughter cells do not occupy a greater volume than the mother cell had done. Each one of the daughter cells proceeds to grow to the size of the mother by doubling in size. There are limits beyond which a cell cannot grow, so that more cells must be formed, i.e. cell division must occur, if increase in size due to cell mass is to occur.

Growth is thus due to an increase in the size of cells, to an increase in intercellular substances, or to both these factors. Among the intercellular substances one may include the air or water swallowed by arthropods during the process of molting as well as the blood. Increase of cell size may be caused by a synthesis of new protoplasm, a synthesis of more storage, i.e. non-living, material such as fat or yolk, or to an absorption of water.

The total constituents of an egg do not increase in size during embryonic growth but the living component, i.e. the embryonic cell mass, grows at the expense of the non-living or non-actively metabolising material.

C. — Development (2)

Morphogenesis, or the assumption of a definite structural form, includes various processes such as evagination, invagination, and delamination of all layers. Morphogenesis, i.e. differentiation, is independent of growth in *total* mass but is often accompanied by such. Development implies growth, morphogenesis, or both these processes, so that it is manifestly an indefinite term and inapplicable to measurement unless broken up into its constituents. It is, nevertheless, useful in cases, precisely because of its general implications.

There is a time sequence in the three-dimensional development of an embryo and this is, in general, antero-posterior (fig. 2). Thorough quantitative studies have been made on the time sequence of development in embryos of the honeybee by Schnetter (1934, 1934a). Beginning from the

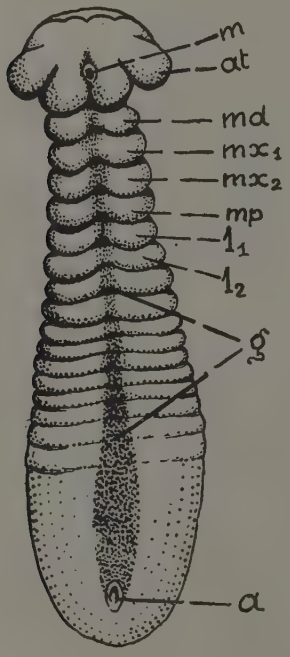

Fig. 2.

A stage in the development of an embryo of a centipede, *Geophilus ferrugineus*, artificially unrolled : *a.* anus; *at.* antenna; *g.* ventral longitudinal groove; 1_1. and 1_2. segments of the first and second pair of walking legs; *m.* mouth; *mp.* maxilliped; *md.* mandible; mx_1. first maxilla; mx_2. second maxilla. — (After Sograff, from Korschelt and Heider).

region between the prothoracic and labial segments there is an antero-posterior time sequence in the total number of cells, measured by the number of

(2) This topic has recently been treated in detail by Richards and Miller (1937). Otherwise there is but little overlapping between our papers.

nuclei forming the blastoderm, as well as a postero-anterior sequence (fig. 3 A, continuous line). The parallel relationship in the number of cells per section of unit thickness (fig. 3A, discontinuous line) to the total number of cells present at different levels shows that there are no localised areas of cell division during the formation of the blastoderm. There is a similar time sequence in the number of cells undergoing mitosis (fig. 3 C). Both figures show that *the number of dividing cells per unit area is directly proportional to the number of cells in that area.*

Fig. 3 A shows that, in an embryo 12 hours after the first cleavage, there is no definite gradient in the number of cells along the longitudinal axis of the embryo. As time proceeds the difference in the number of cells between the differentiation center and the other regions increases due to a slight lead in this region in the number of mitoses occuring per unit

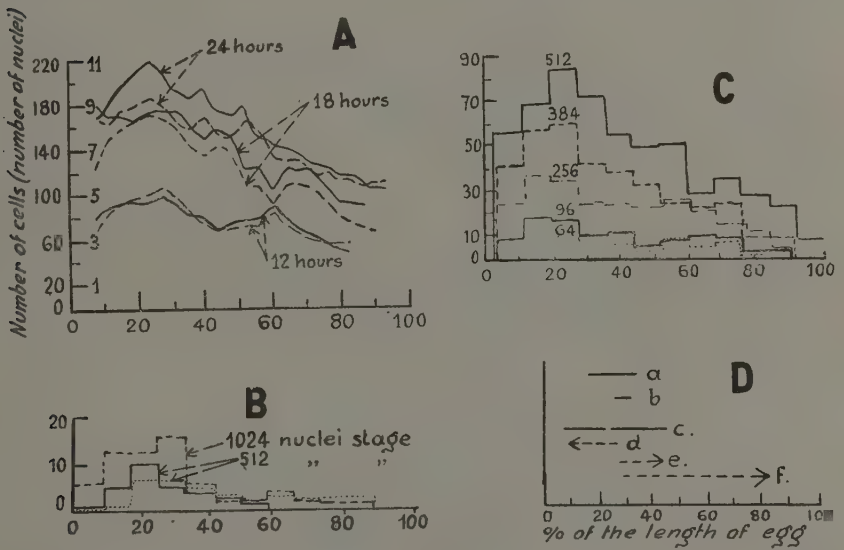

Fig. 3. — A. The total number of cells (number of nuclei) present in different regions along the length of the egg of the honeybee at various periods after the first cleavage (continuous line) and the number of cells per section (broken line, the values being represented by the figures on the right side of the ordinate). — B. The number of vitellophags per 12 sections along the length of the egg at the 512 and 1,024 nuclei stage. — C. The number of nuclei undergoing mitosis per 12 sections along the length of the egg at various periods (represented by the number of cells present in the embryo, a blastoderm). — D. *a.* Position of first formation of the mesoderm; *b.* Position of the first appearing segments; *c.* Position of the mouth parts and thoracic segments; *d.* Time sequence in the differentiation of the mouth parts; *e.* of the thorax; *f.* of the spiracles. — (All after Schnetter).

time, i.e. due to heterochronic mitosis. The number of vitellophags, i.e. yolk-digesting cells, within the yolk exhibits a similar relationship (fig. 3 B). The first signs of the mesoderm and of segmentation appear at the differentiation center (fig. 3 D). The differentiation of the mouth parts (fig. 3 D, *d*) proceeds in a postero-anterior sequence, these organs being posterior to the differentiation center while the differentiation of the thoracic appendages, *e*, and spiracles, *f*, occurs in an antero-posterior sequence from the differentiation center. The anterior amnionic fold, mid gut fundament, and stomodeum appear 4 to 6 hours earlier than the posterior amnionic fold, mid gut, and proctodeum. The differentiation center of all insects so far studied is in the presumptive first thoracic segment (cf. Seidel, 1934).

In the Decapoda and allied orders (van Beneden, 1869; Reichenbach, 1886; Nusbaum, 1887 and 1887 a, and others) the developmental center of the blastoderm is at the most posterior end but the posterior pairs of limbs appear in antero-posterior sequence. The chromatophores of schizopod Crustacea (Keeble and Gamble, 1904) develop from before backwards. In scorpions (Laurie, 1890) and spiders (Balfour, 1880 and 1900) the first differentiation of the blastoderm takes place where the blastoderm first began to form and differentiation is thus antero-posterior. The order of appearance of the limbs of the Pantopoda varies in different forms. Thus, in *Pallene* (Morgan, 1890), the first pair of limbs to appear is the most posterior, the next is the fourth, then follows the fifth and sixth. The third pair develops later but the second pair is lacking. In the Chilopoda, Diplopoda, and Symphyla (Sograff, 1882; Korschelt and Heider) the limbs and segments generally develop from before backward.

In the other plane, development occurs in a ventro-dorsal direction in arthropods, i.e. from the ventral region of the embryo to the dorsal region. This completes the tri-dimensional time sequence in development.

The observations of Child (see for instance, 1921) on planarians, have led him to believe that segmentation (or matamerism) is the result of an independent dominance being acquired in a new region. A repetition of an organ such as a particular group of muscles or a ganglion, thus becomes possible. The segments are, however, integrated into a whole by the nervous system. The larger and more abundant the longitudinal nerve fiber tracts in the central nervous system the more perfect the integration. The segments of arthropods are formed always anterior to a small piece, the telson or periproct, which contains the anus and yields the proctodeal invagination.

Many arthropods, such as the millipedes (Latzel, 1880 and 1884; Heathcote, 1888; vom Rath, 1891), hatch from the egg with an incomplete number of segments. The formation of new segments always takes place between the anal segment, or periproct, and that last developed. Each of the numerous molts that follow the hatching of milli-

pedes is accompanied by the appearance of a new segment with its appendages until the full quota in the sexually mature animal is attained. The same condition holds true for certain centipedes and for the larval stages of many Crustacea such as the Branchiopoda, Stomatopoda (fig. 4) and certain Decapoda which hatch with an incomplete number of segments (e.g. the prawn, *Benaeus*, in which the differentiation and growth of the gills also occurs in antero-posterior sequence). It may be mentioned, however, that the limbs of the maxillary segments of branchiopod Crustacea appear later and are thus

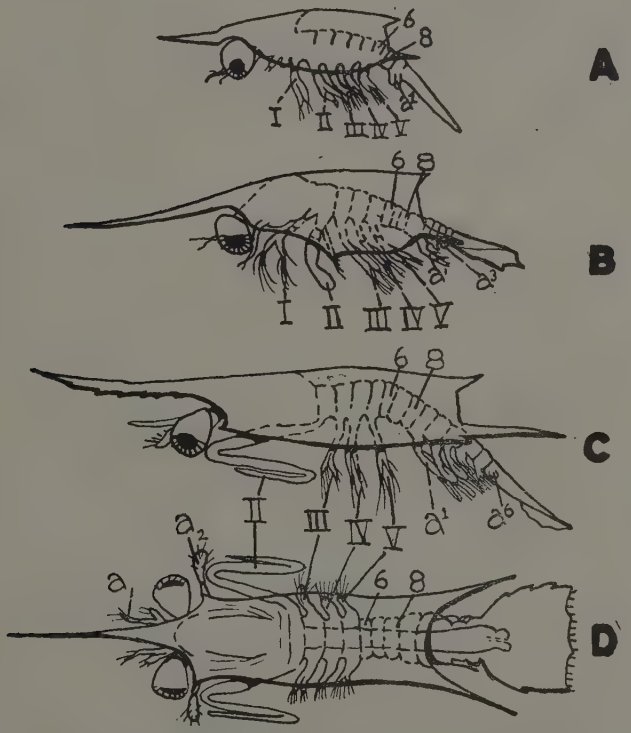

Fig. 4. — A, B, C, and D. Several consecutive larval stages of the stomatopod crustacean, *Erichthus*. a_1, a_2, first and second antennae; a^1 to a^6, the six pairs of pleopods; I to V, the five pairs of maxillipeds; 6, 7, 8, the three posterior thoracic segments which in these stages have no limbs. — (After Claus, from Korschelt and Heider).

exceptional. The result is that, in the adult, they are only slightly developed.

Before a certain stage in the life of the egg or embryo of a particular species destruction of a portion of the egg or embryo may be compensated

for by a regulation or reconstitution of the other constituents so that a normal individual, though diminished in size, is produced. In annelids and molluscs the stage at which regulation is no longer possible is reached at the first cleavage, while in sea urchins it is attained long prior to fertilisation. Hence, formerly, development in the former two groups was called « regulatory » while in sea urchins it was termed « mosaic » because localisation of specific factors was evidently existent in the different regions of the cytoplasm. There is, however, no justification in choosing the time of fertilisation as the time of development. In rare cases, e.g. in rhizopods, fertilisation occurs long prior to any visible developmental processes; in others, such as the sea urchin, invisible developmental changes, such as chemo-differentiation of the cytoplasm, may begin long before fertilisation so that fertilisation probably only starts the trigger action. The difference between « mosaic » and « regulatory » development is just as arbitrary. This arbitrariness is further exemplified by studies on insect embryos in which the regulatory capacity disappears at various stages in different species. When the egg of the domestic fly (Reith, 1925) is laid the nuclei have already begun to divide so that studies prior to this period have not been made. The cytoplasm is, however, as yet undivided and the peripheral cytoplasm contains no nuclei. Damage accomplished by cautery solely to a portion of the cytoplasm allows development to proceed normally except in the injured area where the structure specific for that area does not come into being. This means that the organs do not change in shape or size following injury of a part, i.e. undergo no regulation. The part injured simply does not develop. The hypodermis, however, covers up the injured area. Destruction of the first 2 to 8 cleavage nuclei resulted in entirely no development and the yolk underwent degeneration in a few hours. The development of the ant, *Camponotus ligniperda* (Reith, 1931), is a more advantageous object to study since the egg is laid before the zygote nucleus has begun to divide. It was thus found that regulation is possible up to a certain time before the zygote nucleus begins to divide. It is thus evident that in the fly and ant invisible differentiation or localisation, known as chemodifferentiation because of its invisibility, occurs precociously in the cytoplasm and that division of the cytpolasm plays no part in this irreversible differentiation. Identical results were obtained by Pauli (1927) on the blow-fly, *Calliphora erythrocephala*, and the domestic fly, *Musca domestica*. No regulation has been found possible in the embryo of the beetle, *Leptinotarsa decimlineata* (Hegner, 1908 and 1911). Thus, when the anterior or posterior parts of freshly laid eggs were killed, the material remaining alive developed that part of the embryo which it would have produced if the eggs had remained intact (fig. 5). No regeneration or reconstitution took place. Even in the holoblastic embryo of the copepod,

Cyclops viridis (Jacobs, 1925), when one cell of the 2-cell stage is removed development is of the partial type producing one lateral half of a non-viable nauplius larva in which division into head and body is indistinct. When one cell of the 4-cell stage is left, a quarter partial embryo is produced, there being entirely no reconstitution.

In the dragonfly, *Platycnemis pennipes* (Seidel, 1926, 1928 and 1929) however, regulation is possible even at a comparatively late period, i.e. until when the blastoderm is being formed. In this insect, nuclei must reach the posterior end of the peripheral cytoplasm if development is to take place. As time proceeds increasingly larger parts of the posterior parts may be destroyed without even hindering development. If thus appears that when the nuclei reach the posterior end of the egg they cause the production of a certain substance which diffuses from that region and is necessary to initiate

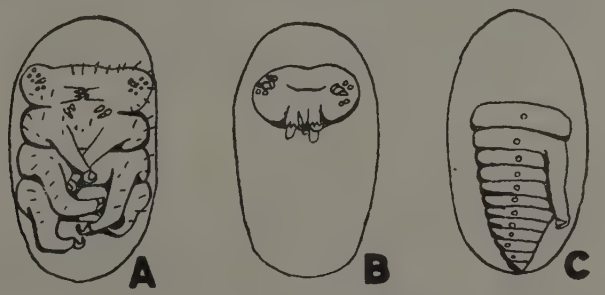

Fig. 5. — A. Ventral view of an embryo of *Leptinotarsa decimlineata* 5 days old. The posterior end of the embryo was killed when in the blastoderm stage. The blastoderm which remained alive produced a normal head and thorax. — B. Ventral view of an 8-days embryo of *L. decemlineata* which had been operated upon. Only a head developed from the tissue which remained alive. — C. Side view of an egg of *L. decimlineata* 5 days old. The anterior end of an egg was killed when in the blastoderm stage. The blastoderm which remained alive produced a normal abdomen and part of the thorax. — (After Hegner).

development. Apparently once a region of the egg cytoplasm receives this substance it is no longer dependent upon the posterior, or activating, region. It should be noted that an activator is not an organiser. The former merely starts development while the latter determines differentiation into particular organs and in so doing must activate a particular type of development.

Students of classical embryology have recognised three fundamental, or germ, layers : the ectoderm, the endoderm, and the mesoderm. The ectoderm is the outer layer and thus functions in the reception of environmental changes and in the protection against environmental agencies. The endoderm is the inner layer and encloses the yolk and storage material of the embryo.

It is thus involved in digestion, storage, and food transformation. The innermost layer is the mesoderm. This produces connective tissue, tissues of internal communication (e.g. the blood), and the tissues of locomotion. There is thus a functional significance to each of the germ layers though, as in the process of regeneration of a limb muscle (ordinarily a mesodermal derivative), muscle can be derived from an ectodermal derivative, the hypodermis. Furthermore, the muscles of the adult limbs of many endopterygote insects are formed *de novo* during metamorphosis from myoblasts of the imaginal buds, which are hypodermal derivatives. Mansour (1927) has found that the mid gut of *Calandra oryzae* beetles arises from apparently ectodermal cells in the fore gut of larva.

D. — Hatching

Hatching or eclosion, may be performed merely by motor action of the larva against the egg shell and in many insects the serosa membrane is hardened into a spine at the head region of the larva so that the activity of the animal is thus concentrated at a single point. The hatching spine of the flea, *Ceratophyllus wickhami* (Sikes and Wigglesworth, 1931), is, however, an actual part of the head cuticle of the first instar larvae. Blowfly larvae (Sikes and Wigglesworth) use their mouth hooks in rupturing the egg shell. The larva of the bedbug, *Cimex lectularius*, like many other insects, swallows the amniotic fluid before hatching. Antiperistaltic movements of the gut and abdominal wall drive the blood and the swallowed fluid into the head and thus dislodge the cap of the egg (Sikes and Wigglesworth). Tillyard (1916) first called attention to the fact that the so-called « cephalic heart » of hatching dragonfly larvae was in reality the peristaltic movements of the posterior portion of the œsophagus which contains amnionic liquid (which, however, he erroneously believed to be « blood in which no corpuscles are present ») and which thus, by these movements, « causes the head to swell up... The extra pressure caused by this and by the forward movement of the mid gut would rupture the pronymphal sheath as well as lifting up the egg pedicel ». Tillyard also observed that the apparent division of the « cephalic heart » into two chambers is very probably due to compression of the œsophagus against the endoskeleton of the head, i.e. the tentorium. The larvae, in many eggs which are directly in contact with atmospheric air, swallow air into the gut, contract the abdomen, and thus force off the cap or anterior portion of the egg shell by increasing the blood pressure in the head. This pressure is often concentrated at hatching spines. It should be noted that the mere swallowing of the amnionic fluid will not cause an increase of pressure within the egg since this fluid forms a part of the egg contents.

Only by the propulsion of this fluid and of the blood into the head and,

thus, by exerting a centrifugal force on the integument of the head can the pressure within the egg be increased. The actions producing such a force are, as has already been described, antiperistaltic movements of the gut, contraction of the trunk segments, and the swallowing of air. Either one or all of these actions may take place, depending upon the species.

The work of Roubaud (1927) on the larvae of the yellow fever mosquito, *Stegomyia fasciata*, seems to show that proteolytic enzymes in the external aqueous medium are, in this case, necessary for hatching. No eclosions occurred from fully developed eggs when the external medium was pure water or had only a few micro-organisms. Mass eclosion could be effected by introducing *Bacillus coli* bacteria, by filtered extracts of the same, or by the addition of pepsinase or trypsinase to the external medium. Proteolysis of the egg shell is thus apparently necessary for hatching in this species and shows that the egg shell consists largely of protein material — a statement also substantiated by more direct facts (p. 119). Culicid mosquitoes on the other hand, could hatch in pure water. Williams (1933) has produced good evidence that grasshopper embryos, after blast okinesis, secrete a hatching enzyme which greatly decreases the tensile strength of the egg shell.

There are certain cases among aquatic arthropods in which the rupture of the egg membrane is apparently the result of a centrifugal force exerted on it and produced by a rise in the osmotic pressure of the embryonic fluids. Needham (1931) has described observations of Przylecki which show that the osmotic pressure of the embryonic fluids of the freshwater cladocerans, *Simocephalus vetulus* and *Daphnia magna*, rises during development (from –0.186° to –0.739° in *D. magna;* and from –0.245° to –0.752° in *S. vetulus*) presumably due to a liberation of metabolites. Following this there is an influx of water so that the egg membrane bursts and the embryo increases in volume (and mass). Ramult (1925) found that, after the formation of the egg membrane, the embryo of *Daphnia pulex* can differentiate in NaCl up to a concentration of N/6. While they differentiate (« develop », as he terms it) fairly normally in such a solution, growth was entirely stopped and the egg membrane did not burst. If prolonged, such a condition caused the decease of the embryo, but if returned to normal conditions the animals developed normally and the membrane then burst. A N/20 solution of NaCl (Δ = approx. –0.16) was the maximum concentration which could be competent with hatching and normal development. The question can nevertheless be brought up as to whether the incapability of the embryo of *D. pulex* to hatch in solutions above a certain concentration is due to its lack of growth or merely due to the relatively high osmotic pressure of the external medium — « osmotic hatching », as Needham puts it. This query has not as yet been answered and so we are not justified in ascribing osmotic hatching to the above cladocerans.

E. — Respiration

In all living organisms two processes are proceeding simultaneously : chemical degradation and chemical synthesis. Both processes are essential for the maintenance of life. It is generally true that when an organism is loosing mass the processes of degradation are in excess of the synthetic ones ; that both events are equal when an organism maintains a constant weight ; and that the synthetic reactions are in excess of the degradation reactions when an organism is increasing in mass. There are, of course, numerous exceptions to this rule, such as when an animal imbibes food or water, or when an animal defaecates, or sheds its integument.

Oxygen reaches the tissues of an anthropod embryo chiefly by diffusion. The study of respiration in arthropod embryos is thus confined almost solely to that of oxidations. It is probable, however, that the rhythmic contractions which the lateral regions of the body wall of grasshopper embryos undergo during and after blastokinesis (Thompson, 1934 ; Walker, 1934) aid in gaseous exchange and are hence, *ipso facto*, respiratory.

The egg shells of some Hydradephaga beetles (Balfour-Browne, 1935) are adapted so that the embryos can respire dissolved air. The eggs of other Hydradephaga beetles are imbedded in plant tissues under the water level. The latter type of eggs will hatch if extracted and kept on wet cotton but will not do so if submerged in water. Such eggs, therefore, obtain air from the inter-cellular air spaces in plants and cannot obtain such in adequate amounts from solution. The eggs of the bed bug, *Cimex lectularius* (Bacot, 1914), when submerged in water at 15° to 17°C. for five days, will hatch if subsequently kept under favorable conditions. The eggs of mosquitoes are laid in a compact mass on the surface of the water. Owing to the hydrofugous properties of their egg shell, they will, even when submerged, possess an air film all around them. This keeps them buoyant and lighter than water, and when they rise to the surface they are quite unwetted. Mosquito eggs, therefore, always respire atmospheric air. The eggs of the dragon-fly, *Anax papuensis* (Tillyard, 1916) are laid on the stems of plants from an inch below the water level downwards. Tillyard divided dragon-fly eggs into two categories : exophytic and endophytic. The former are dropped directly into the water or attached to the outer portions of plants, being surrounded by a gelatinous envelope enclosing entirely no atmospheric air. Such eggs are wholly dependent upon oxygen in solution. The gelatinous envelope probably prevents desiccation to which such eggs, owing to their thin shell or chorion, are very susceptible. The latter eggs are laid inside the tissues of plants and probably utilise atmospheric air in the intercellular spaces of the plants. The eggs of most terrestrial arthropods respire atmospheric oxygen. The eggs of Crustacea, on the other hand,

respire oxygen in solution. In all cases, however, before oxygen enters the cells it must pass into solution in the fluids bathing such.

The actual values for the rate of respiration of arthropod eggs, now at hand, do not represent the rate per given weight of actively metabolising (i.e. living) material, for, in no case has the respiratory rate of an arthropod embryo, throughout its life, been expressed in terms of the mass of living substance. Melvin (1928) came closest to this when he reckoned his results in terms of shell-less eggs (fig. 6). The curves obtained by including the shells in the mass were similar but, of course, showed lower values. The curves could not be similar if also the extra-embryonic food-stores

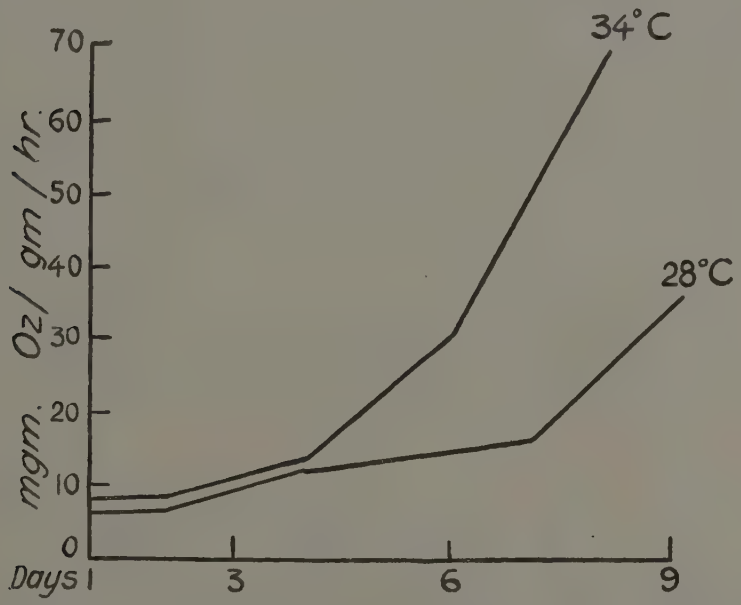

Fig. 6. — The oxygen consumption rate of shell-less eggs of the moth, *Samia cecropia*, throughout their development. — (After Melvin).

(yolk) were removed, for, the latter decreases with the age of the embryo. While the data at hand (figs. 6 to 9) are suitable for comparison, it should be pointed out that the more rapid rate observed to occur during the latter part of development may be purely illusory and merely due to the absolute increase in living, i.e. actively metabolising, material. The probable mythical nature of a « low formative period » conceived by Fink (1925) to occur during the early part of the embryonic life of insects hereby becomes apparent. Work on other embryos, in which the rate of respiration

is expressed with respect to the total amount of living material shows that, in general, the rate is greatest when the rate of growth is greatest, i.e.

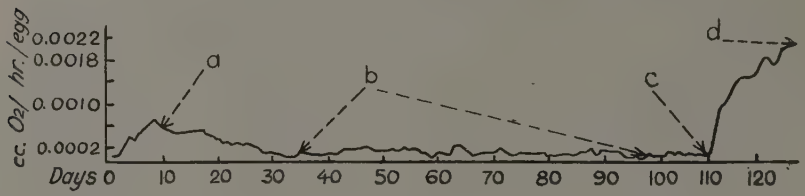

Fig. 7. — The oxygen consumption rate of a single egg of the grasshopper, *Melanoplus differentialis*, at 28° C., throughout its entire development: *a.* mitosis rapidly taking place; *b.* hibernation; *c.* beginning of revolution; d. hatching. — (After Burkholder).

during the early rather than during the late stages of development (see Needham, 1931). The accelerated rise in the rate of respiration which occurs late during embryonic life (figs. 6 to 9) is very probably due to motor activity of the embryo. This statement is also supported by the fact that, at the close of hibernation, when revolution of the embryo (blastokinesis) takes place, the respiratory rate rises (fig. 7, *c*) and continues to do so until the time of hatching, *d*. See also Bodell (1935) who, by the use of an improved technique, found the maximum rate at 25° C. to be on the 20th. day.

When mitosis and chemical synthesis are rapidly taking place the rate of oxygen consumption of an embryo is relatively high (fig. 7, *a*). During hibernation the rate becomes very low, *b*, and represents solely the cyanid

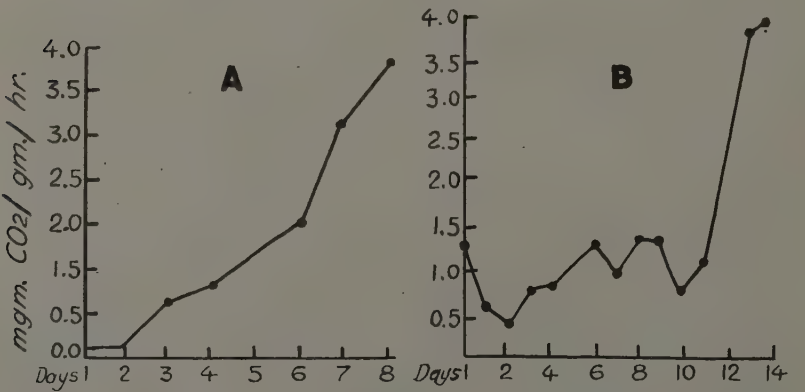

Fig. 8. — The carbon dioxid evolution rate of an egg of A. the beetle *Crioceris asparagi*, and B. of the beetle *Popillia japonica* throughout their development. — (After Fink).

and carbon monoxid non-poisonable component (Bodine, 1934b; Bodine and Boell, 1937).

Warburg (1928) has propounded a plausible hypothesis which holds that iron is an important catalyst in aerobic oxidations. Since the respiratory rate of embryos during hibernation differs markedly from that during activity, Bodine and Wolkin (1934) attempted to test Warburg's theory on insects. There are no significant differences in the iron content of the egg *as a whole* during development since the egg does not discharge or take in iron, i.e. is a closed system as far as iron is concerned. Since from the 3-week stage (i.e. at the approach of hibernation at 25°C.) the embryos of *Melanoplus differentialis* could be easily freed from the surrounding yolk, it was possible to show that as development proceeds the amount of iron in the yolk decreases while the amount in the embryo increases at the same rate, i.e. as the protoplasmic mass of the embryo increases its iron content increases *proportionately*. The *concentration* of iron in the embryo thus remains constant even during the period of hibernation when the rate of respiration is minimal and, therefore, appears to have no relationship to the rate of oxidation even though the rate of oxidation of the egg varies directly with the *total* iron content of the embryo (fig. 9) except during the

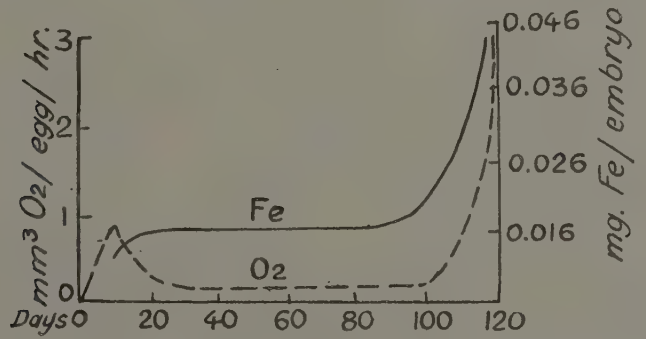

Fig. 9. — The iron content and oxidative rate of a developing egg of the grasshopper, *Melanoplus differentialis* (Temp. 25° C.). — (After Bodine).

first three weeks of development, i.e. prior to hibernation, when, it should be noted, activity is pronounced (fig. 7). Warburg's hypothesis hence does not appear to find support from these results. While iron may be an important catalyst in aerobic oxidations, Warburg's theory does not, however, insist that iron is the one agent in determining the rate of oxidations. But Bodine suggested that there may be differences in the degree of « saturation » of the iron present in the embryo at different stages.

As for oxidases, Burge and Burge (1921) found that the fertilised

egg of the beetle, *Leptinotarsa decimlineata*, has twice as great a catalase activity as that of the unfertilised egg. That the catalase activity is not necessarily a measure of the metabolic rate has already been pointed out (Morgulis, 1921; Fink, 1930). Bodine and Boell (1935) consider that, when the yolk and serosa cells of the embryo of *Melanoplus differentialis* are engulfed, tyrosinase is transferred from the serosa cells and yolk to the embryonic cells.

F. — Effects of Various Agents

(1) Temperature. — A rise in temperature, within limits, increases

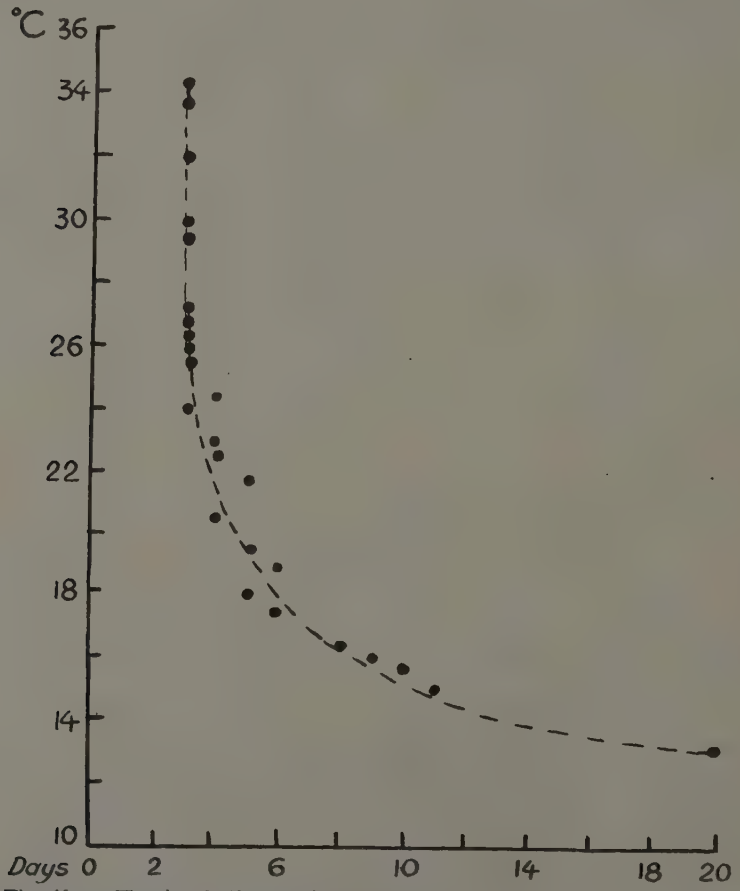

Fig. 10. — The incubation period for the hatching of the moth, ***Prodenia litura***, from the egg. — (After Bishara).

the rate of oxidative metabolism and all chemical reactions. It, therefore, proportionately decreases the time required for development (fig. 6). No single empirical formula can precisely describe the relationships of temperature to the rate of a biological reaction (Belehradek, 1930). And, as Uvarov (1931) has pointed out, « authors who aim at expressing the relation between temperature and development by very exact formulae and curves should base their mathematical speculations on more reliable data than the external temperatures which often differ considerably from the body temperatures, *the difference moreover not being constant* ».

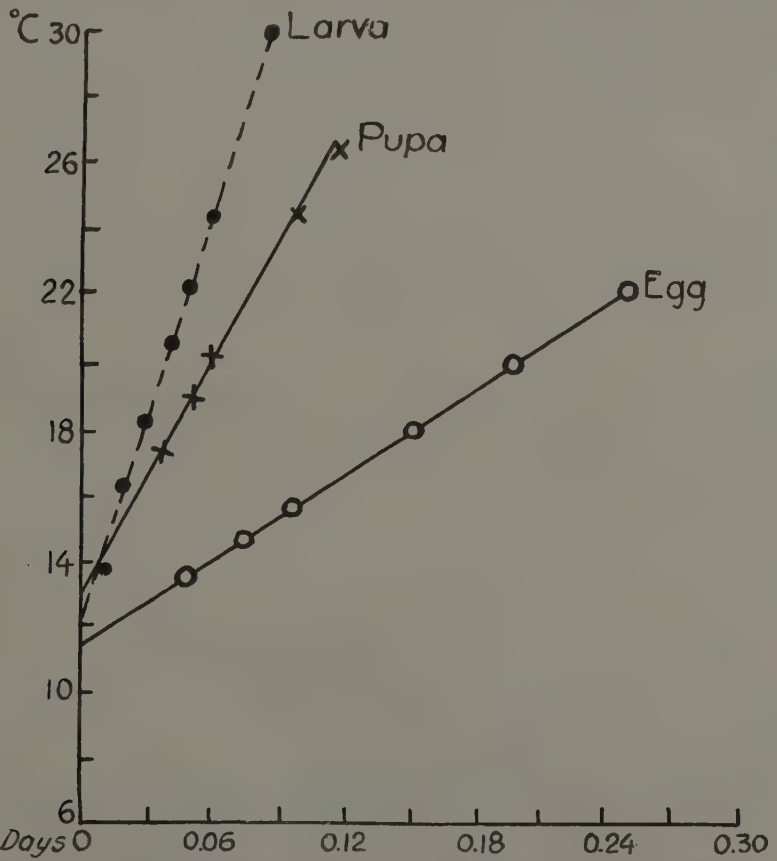

Fig. 11. — The amount of development per day, i.e. the rate of development (abscissa), of the egg, larval, and pupal stages of the moth, *Prodenia litura*, at various temperatures. The abscissa represents the hypothetical amount of development per day when the total time interval for each stage at a given temperature is taken as 1. — (After Bishara).

In the case of embryonic life, and in the case of pupal life especially, the rate or velocity of the total period of development may be measured by the reciprocal of the time taken for hatching or emergence. It is thus possible to determine the relation of temperature to the rate of development. In so doing we consider that the total period of development equals 1 and that when 1 is divided by the time required for development, we obtain the average amount of development per day (fig. 11).

The duration of the egg stage of the moth, *Prodenia litura* (Bishara, 1934), varies inversely with the temperature, within limits, in the form of a hyperbolic curve (fig. 10). The shortest incubation period of 3 days occurs at 26° C. and over, while the longest duration obtained was at 13.5° C.. Since the reciprocal of a hyperbola is a straight line, the relationship of the developmental rate (the reciprocal of the incubation period) to the temperature would be expected ti be a straight line. This is, in fact, the case (fig. 11). By extrapolation of the straight line towards the ordinate it is possible to find the theoretical critical temperature at and below which no development is possible. For the embryos of *Prodenia* this was 11.5°C. (fig. 11). Straight line developmental velocity-temperature curves have been shown to hold true for the embryos of various insects (Pearis, 1927), the beetle *Coccinella septempunctata* (Jöhnssen, 1930), and the homopteron *Trialeurodes vaporarium* (Weber, 1931). While, however, for the greater part of the range of temperatures permitting development the velocity of development is a straight line, Pearis (1927) noted that at the upper end the departure from the straight line is in the direction of a slowing up and at the lower end in the direction of an acceleration. Such a condition has already been noted in other biological processes, where the significance of the van't Hoff temperature coefficient (Q_{10}) and of the van't Hoff-Arrhenius thermal characteristic (μ) have been discussed (Belehradek, 1930 and 1935). The low temperature at which development does not occur Pearis thus found to be somewhat lower than the theoretical critical temperature demanded by a strict straight line curve.

The Q_{10} and μ values are not constant for any stage in the development of the beetle, *Popillia japonica* (Ludwig, 1928), or of the mantis, *Sphodromantis religiosa* (Przibram, 1917) but, as would be expected diminish as the temperature is increased.

The optimum temperature for development is the temperature at which the greatest percentage of animals are able to complete normal development. This is not usually the temperature of greatest developmental velocity. Thus the optimum temperature for the embryonic development of the moth, *Prodenia litura* (Bishara, 1934), is between 28° and 30°C.. From 30° to 35°C. development may be more rapid but mortality is greater, especially above 33°C.. A temperature of 40°C. is destructive to these embryos if

maintained for over 24 hours. It should be born in mind that only in embryos, such as *P. litura*, which develop equally in dry as well as in moist atmospheres, can an optimum temperature be considered by itself. In other cases the optimum temperature must be related to the relative humidity as another variable (p. 110).

The effects of alternating temperatures on embryos of *Popillia japonica* (Ludwig, 1928) are as follows : (1) If one is above the optimum temperature, development seems to be retarded ; (2) if both are between the critical (threshold) and optimum, neither a retardation or an acceleration is produced ; (3) if one is below the critical, an acceleration of development is produced. The causes for such relationships are not known. We do know, of course, that the basal metabolism of a *homoiothermic* animal is raised in low temperatures due. But the embryo of an insect is a poikilotherm, if any animal is, and lowering the environmental temperature would thus presumably lower its basal metabilic rate.

(2) Humidity. — A gelatinous envelope protects the eggs of dragonflies (Tillyard, 1916) from the air during the short time that elapses between their passage from the body of the female and their being dropped into the water. Even momentary contact of these eggs with the air « seems fatal, probably owing to the desiccating influence of air upon eggs constructed

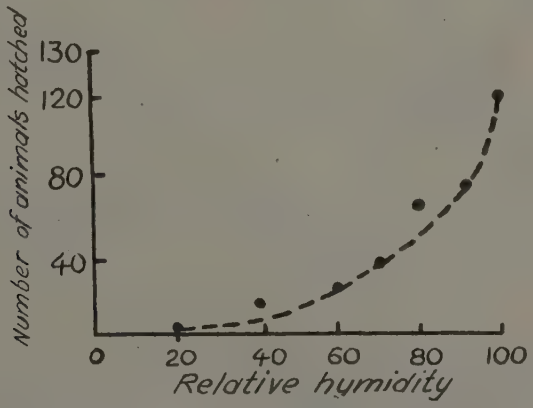

Fig. 12. — The number of eggs of the locust, *Schistocerca gregaria* hatched out of a given batch at 30° C. when reared in various constant relative humidities. Temp. 30° C. — (After Bodenheimer).

especially for submergence ». At the other extreme are the eggs of the cotton moth, *Prodenia litura* (Bishara, 1934), in which, as far as hatching time and normal development is concerned, « no difference could be detected from the driest to the most humid chamber ». The egg shell of these moths,

is thus, unlike the thin egg shells of dragonflies, practically impervious to moisture. Somewhere between is the egg of the blowfly, *Lucilia sericata* (Cousin, 1932), which takes 12 hours to hatch in a dry atmosphere but 10 hours in an ordinary atmosphere (temperature 29.5°C.). The development of the blow-fly, *Calliphora vomitoria* (Cousin, 1932) is retarded in a very dry or a very humid atmosphere. Grasshopper embryos (Slifer, 1934) can withstand dehydration to a much greater extent than vertebrate embryos. This is of adaptive significance in desert regions. In 0 % R.H. development of grasshopper embryos is stopped entirely by swings back to normal in favorable conditions.

In studies on the optimum relative humidity, temperature should be taken into consideration as another variable. The optimum temperature-humidity combination is the *vital optimum*. For the embryos of the locust, *Schistocerca gregaria* (Bodenheimer, 1929), this lies at 30°C. and 100 % R.H. (fig. 12). At 18°C. and 43°C., even at optimum humidity, the eggs of the locust do not hatch. The higher temperature limit was determined by extrapolation.

(3) Dehydration. — Since the shell of the egg of the grass-hopper, *Melanoplus differentialis* (Bodine, 1932 and 1933), is permeable to

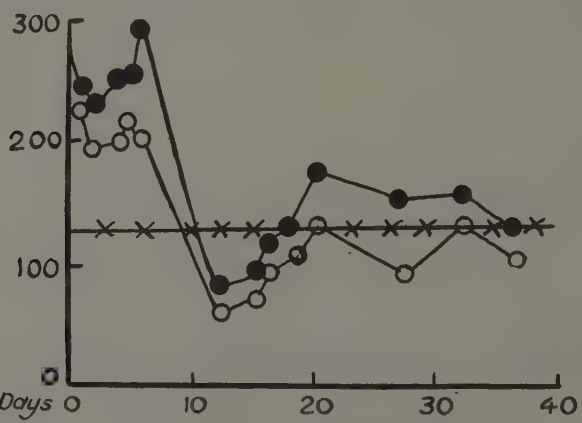

Fig. 13. — The effects of abnormally high oxygen tensions upon the oxygen consumption rates of hibernating and non-hibernating eggs of the grasshopper, *Melanoplus differentialis*

Ordinate : % O_2 consumption as compared with that in ordinary air (in which the O_2 tension is 160 mm. Hg) - 100.

Abscissa : time in days from beginning of hibernation. —x—x—x—x— = non-hibernating controls; —o—o—o—o— = hibernating eggs under an O_2 tension of 760 mm.; -●-●-●-●- = hibernating eggs under an O_2 tension of 380 mm. Temp. 25° C. — (After Bodine).

water but impermeable to salts, it can be dehydrated by immersion in a hypertonic saline solution. The decrease in the oxygen consumption rate of such eggs is roughly proportional to the osmotic pressure of the surrounding medium and reversible decrease of from 60 to 70 per cent of the normal rates are possible. Such treatment of eggs is probably the same as placing them for a time in a dry atmosphere. Dehydration may affect the rate of oxygen consumption by concentrating the cellular substances below the level when the velocity of the reactions is proportional to the concentration of the reacting components.

The entrance into a state of anabiosis of the eggs of certain barnacles and branchiopods when subjected to dessication enter into a state of anabiosis (Monterosso, 1920, and others). On the other hand, diapause of the *Branchipus stagnalis* embryo (Mathias and Bonat, 1934) can be abolished by placing in dehydrating solutions (e.g. hypertonic sea water, absolute alcohol, and concentrate H_2SO_4), the time required for effective results before returning to regular sea water varying inversely with the temperature.

(4) Oxygen tension. — The effects of the oxygen tension of the surrounding atmosphere on the rate of oxygen consumption of an arthropod embryo were studied by Bodine (1934) and Bodine and Boell (1937)

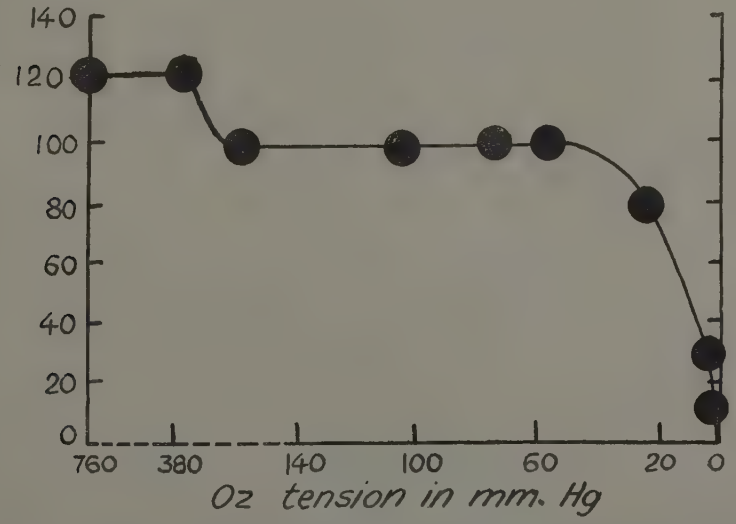

Fig. 14. — The relationship of the oxygen tension of the air to the rate of oxygen consumption (ordinate) of embryos of the grasshopper, *Melanoplus differentialis*, as compared with the rate in ordinary air (in which the O_2 tension is 160 mm. Hg) = 100. The broken line represents the condition in embryos after the completion of hibernation; the continuous line represent the condition in hibernating and non-hibernating types of embryos. Temp. 25° C. (After Bodine).

on the grasshopper, *Melanoplus differentialis*, which lays two types of eggs: hibernating and non-hibernating eggs. Both types of eggs do not have their oxygen consumption rate affected in oxygen tensions of 60 to 160 mm. of Hg, i.e. in atmospheres containing 8 to 21 % O_2 (fig. 13). In early stages of hibernation the rate of oxygen consumption is greatly magnified above normal in abnormally high oxygen tensions (fig. 14) but in later stages of hibernation the super-normal rate becomes small, resembling that for normal growing eggs. Similar results were obtained on silkmoth eggs by Luciani and Piutti (1888). The respiratory rate of eggs soon after hibernation is also accelerated by abnormally high oxygen tensions (fig. 13) but depression follows if the condition is prolonged. At O_2 tensions below 60 mm. of Hg (temp. 25° C) the oxygen consumption rate becomes a direct function of the oxygen tension of the air in both hibernating and non-hibernating eggs (fig. 14). The oxygen consumption rate of the embryo *freed from its shell* becomes a direct function of the oxygen tension at oxygen tensions below 40 mm. Hg.. At such a tension the cells must hence be oxygen-saturated. When the shell is left intact the critical pressure is higher probably due to the hindrance offered by the shell to oxygen diffusion.

The lack of any marked effect of abnormally high oxygen tensions upon non-hibernating embryonic cells is in full accord with the view that the rate of respiration is not accelerated by oxygen tensions in the surrounding medium when these tensions are higher than the oxygen tension of the cells. The reason hibernating embryos and embryos soon after hibernation are initially affected by abnormally high oxygen tensions is obscure.

(5) Carbon dioxid. — When the eggs of the silkmoth, *Bombyx mori* (Quajat, 1897), are exposed, in summer, to almost pure CO_2 for 150 hours no hatchings result, as they normally should, in the following spring. During hibernation, when the rate of metabolism is much lower, exposure for as many as 50 days to almost pure CO_2 does not cause mortality. This may be due to the fact that, during hibernation, the respiration consists solely of the cyanid- and carbon monoxid-unpoisonable components of the oxidation-reduction system.

(6) Metallic mercury vapor. — Quajat (1897) remarked that minute quantities of mercury vapor cause the death of developing silkmoth embryos upon fairly prolonged exposure to such, but that during winter, when the eggs hibernate, and thus probably utilise only the cyanid-unpoisonable component of the oxidation-reduction system (p. 104), they are less sensitive to mercury vapors. Burkholder (1934) *assumed* that the mercury with which he had calibrated his manometers was the cause of the death of the grasshopper embryos placed in such even after the manometers had been washed several times with cleaning solution. Fenn (1935) has not observed such effects even with naked vertebrate tissues.

The cause of death from mercury or from any heavy metal is, at least in part, due to the fact that heavy metals have a precipitating and hence destructive effect on enzymes.

(7) Effects of various agents on the production of wings in aphids. — Parthenogenetic female aphids (p. 113) and male aphids may be either winged or wingless depending upon certain environmental conditions occurring when they had been in the embryonic state. This implies that whether or not winged offspring will be produced depends upon the environmental conditions about the female parent during the embryonic life of its offspring, for, these animals are generally oviviviparous. In very many cases the young hatch from the eggs of parthenogenetic females when in the reproductive tract of the parent.

The external agents tending to produce winged or wingless offspring have been found to be as follows :

(a) *Light conditions* (Shull, 1928). — Wingless parthenogenetic females of *Macrosiphum solanifolii* reared in continuous electrical light (200 watts), from which heat effects were excluded by immersing the bulbs in running water, produced almost exclusively wingless offspring. The result was only a little less marked in continuous darkness with the exception of a few minutes daily. Mostly winged offspring were produced when the females were reared in alternating light and darkness in the following manner :

Light conditions of rearing	Type of offspring
2 hours daylight : 22 hours darkness	3/4 offspring winged
5 hours daylight : 19 hours darkness	Almost all offspring winged
8 hours daylight : 16 hours darkness	Almost all offspring winged
12 hours daylight : 12 hours darkness	Few wingless females

It will be noted that an alternation of about 8 hours light and 16 hours darkness were most effective in producing wings.

There arrives a certain stage during development when the effects of external conditions cannot be altered. Thus, young oviviviparously deposited aphids, 1 or 2 hours after birth, were incapable of being altered but were winged or wingless according to the conditions under which the parents had lived. When the light conditions about the parents were changed from 8 hours light to 24 hours light per day, they continued to produce winged offspring for

approximately 48 hours after the change and wingless offspring thereafter. It is therefore evident that wing determination occurs in young aphids at some time within the last 2 days before birth. At this time the body and appendages are definitely differentiated and the eyes are pigmented. Gregory (1917) had suggested that the wing fundaments appear to be present in all the embryos and depend upon external conditions for the stimulation or suppression of their growth.

That the effects of alternating differences in light conditions were exerted directly upon the aphids and not indirectly, i.e. through changes in the photosynthesis of the host plant, was shown by the fact that the light conditions in which the plants had been kept produced no effect on the wing production.

(b) *Various chemicals* (Shinji, 1918). — Attempts were made to find out if the type of food ingested by the aphids has any effect on wing

TABLE I

The influence of various material on wing production in aphids.

SOLUTION	NUMBER OF WINGED INDIVIDUALS IN BROOD	NUMBER OF APTEROUS INDIVIDUALS IN BROOD
$AgNO_3$	51	0
$CuSO_4$	34	1
$HgCl_2$	31	6
$NiSO_4$	955	5
$SbCl_3$	41	5
$PbCl_2$	12	2
$SnCl_4$	579	8
$ZnCl_2$	49	2
Mg salts	840	9
Sugar	512	4
Alcohol	288	2
Alum	3	34
Acetic acid	0	67
Na Salts	2	1,029
Ca salts	1	433
K salts	3	324
Sr salts	1	220
Tannin	1	14
Urea	5	153
Distilled water	0	394
Tap water	17	461
Peptone	—	15

production in the offspring. The parthenogenetic females were fed on a rose twig placed in washed sand which was moistened with various aqueous solutions. Any differential effects on wing production, provided other factors are constant, would therefore be due to the dissolved materials imbibed by the rose twig.

The results are shown in Table I and indicate that the salts of magnesium and heavy metals (such as silver, mercury, copper, and lead) allow the production of a proportionately greater number of winged individuals, while sodium salts very definitely inhibit wing development. Certain of the salts appear to produce toxic effects as shown by the relatively smaller progeny they seemed to allow.

The environmental conditions were well controlled and mere wilting of the plant was not observed to produce any effects. « The drying out of the plant may, however, indirectly help to produce the winged insects by concentrating the ingredients in the plant tissues ».

(c) *Nutrition.* — Experiments on the effects of starvation on the wing development of the aphid, *Microsiphum destructor*, made by Gregory (1917) seem to indicate that a lessening in the food supply is a primary factor in determining the development of wings in the offspring of wingless females. Females were reared from youth, under conditions of starvation for 8 hours out of each 24 hours. Effects of starvation on wing development were not apparent on the individuals starved but upon their offspring.

Wing formation was not due to a reduction in the number of offspring produced per female with a consequent rise in the percentage of winged individuals, for, the average family consisted of 50.2 members in the starved lines and 52.2 in the controls. These differences are not large enough to modify Gregory's conclusions.

Gregory's results were confirmed by Shull (1928) on the aphid, *Macrosiphum solanifolii*, who found that aphids fed for 8 or 12 hours daily in continuous light produced more winged offspring than those provided with food continuously in continuous light but not so many as those which fed continuously in 8- or 12-hour light per 24 hours. Light conditions are, therefore considerably more important in wing production than are states of nutrition.

The enhancement of wing production by deficient food supply or by metallic salts seems to be of adaptive significance in allowing the species to disperse to more favorable environments.

G. — Energy Sources of Development

The energy necessary for maintenance and chemical synthesis is obtained from the oxydation and hydrolysis of organic compounds : chiefly carbohydrates, fats, and proteins. The paramount source of hydrolytic energy is

probably obtained from glycolysis (degradation of glycogen to glucose and lactic acid) and was first expressed by Otto Warburg and then reiterated by various authors in the phrase : « No growth without glycolysis ».

During the embryonic development of the silk moth (Tirelli, 1931) there is a decline in the glycogen content (fig. 15) particularly in the later

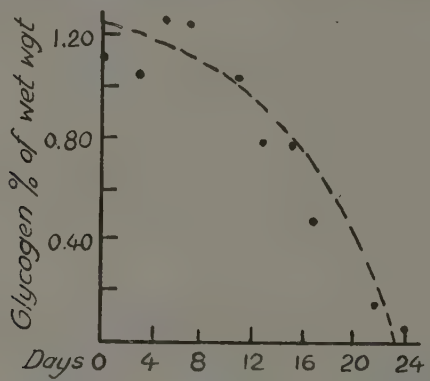

Fig. 15. — The decline in the glycogen content of a non-hibernating egg of the silkmoth, *Bombyx mori*, during development. — (After Tirelli).

stages. The fluid of the egg and embryo was found to have a « glycolysase ». This « enzyme » is probably a group of enzymes. As far back as 1885, Tichomiroff had found that, during development, the embryos of the

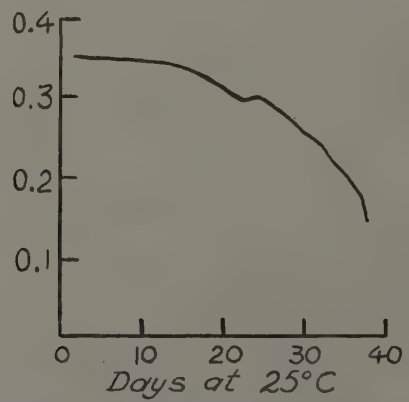

Fig. 16. — The decline in content of higher fatty acids of a non-hibernating egg of the grasshopper, *Melanoplus differentialis*. Ordinate: mg. higher fatty acids per egg. — (After Slifer).

silkmoth lost glycogen and, therefore, utilise this substance as a source of energy.

While hydrolysis by itself furnishes a certain amount of energy, glycolysis is necessary as a preliminary stage in the oxidation of glucose, for, glycogen as such cannot be oxidised by living cells. The fact that during the cleavage stages of the embryonic life of the crab, *Carcinus maenas* (Needham, 1933), the respiratory quotient is approximately unity shows that almost only carbohydrate is being oxidised. By the time that the yolk has diminished to 4/5 of the diameter of the egg the R. Q. has fallen to 0.72 showing that only fat is being oxidised. After this there is a slow rise in the R. Q. which, however, does not exceed 0.83 even by the time of hatching. There is thus an indication of a predominance in the combustion of carbohydrate as a source of energy during the early stages of development, followed by a predominance in the combustion of fat, and later of both fat and protein. Fat and protein are the main constituents of the stored « yolk » material. The high R. Q. values of 1.1 to 1.3 obtained by Luciani and Piutti (1888) for silkmoth embryos are probably due to certain errors in technique rather than, as they supposed, to the synthesis of complex molecules.

The utilisation of fat or carbohydrate as sources of energy during embryonic life, in *lieu* of protein, is suitable in an embryo which is enclosed by a shell and thus, if terrestrial, has no means of getting rid of nitrogenous wastes to the exterior. The higher fatty acid content of the newly laid egg of the grasshopper, *Melanoplus differentialis* (Slifer, 1930), contains from 9 to 12 per cent fatty acids of the total wet weight or from 17 to 22 per cent of the total dry weight. As development proceeds the amount of fatty acids falls (fig. 16) and, by the time of hatching, less than 50 per cent of the initial amount remains. During the early stages of hibernation of this embryo the amount of fatty acid present decreases only slightly. Tichomiroff (1885) had found that, during development, silkmoth eggs lose in an insoluble protein (present in the egg shell), glycogen, fat, and cholesterin.

Fink (1925 a) has noted that the respiratory quotient obtained from various insect embryos rarely rises above 0.7. The results obtained are as follows :

Embryo	R.Q.
Squash bug *(Anasa tristis)*	0.52 - 0.73
Colorado potato beetle *(Leptinotarsa decimlineata)* ..	0.51 - 0.68
June beetle *(Cotinis nitida)*	0.41 - 0.52
Japanese beetle *(Popillia japonica)*	0.41 - 0.73

The low values indicate, at first glance, that there is an incomplete

combustion of fat (probably into carbohydrate in the formation of cuticular chitin). Since, however, we do not know anything about the alkali reserve (carbon dioxid combining substances) of these eggs nor anything about their caloric quotient, we are not justified in assuming that no CO_2 is being bound and that the R. Q. values are, thus, not illusory representations of the truth. In fairness to Fink, it should be pointed out that, while he surmised that the substances oxidised are chiefly fat, he offered no explanation for respiratory quotients lower than 0.7.

Not only does the silkmoth embryo use glycogen as a source of energy but also protein. The work of Pigorini (1923 and 1924) and of Monzini (1921), shows that, during the development of the silkmoth embryo, the albumen (proteins soluble in distilled water), the vitellin and nucleoprotein (proteins soluble in 0.5 per cent NaOH solution), the ovomucoid (proteins soluble in water, but incoagulable by heat, and liberating reducing substances on acid hydrolysis), and the free amino nitrogen declines, while the globulin increases and may, possibly, be formed from the ovomucoid. The total nitrogen content of the eggs remains constant throughout development, there being no appreciable discharge of gaseous nitrogen. This was shown to be true for the silkmoth egg by Farkas (1903) and Peligot, and for the egg of the bee by Henneberg. The significance of a uricotelic type of protein degradation in a terrestrial oviparous embryo, i.e. in an embryo which has no means of discharging its nitrogneous wastes to the exterior, is pointed out by Needham (1929 and 1931). The rise in the percentage of total nitrogen in the eggs of the moth, *Malacosoma americana* (Rudolfs, 1926 and 1932), is only apparent, probably being due to a decline in the fat content.

The egg of the crab, *Emerita analoga* (Needham and Needham, 1930), is very lecithic, i.e. contains a considerable amount of « yolk » (a lecithoprotein) as shown by the relatively high content of ether-soluble phosphorus (Table II). During development, the amount of lecithin declines. In the alecithal egg of the brine « shrimp », *Artemia salina*, there is, on the other hand, a synthesis of ether-soluble phosphorus. In both cases the total amount of phosphorous is constant (Table II). In *E. analoga* embryos the inorganic P increases at the expense of the ether-soluble P, thus showing that lecithin is being utilised — a fact also borne out by the R. Q. (p. 117).

A developing egg decreases in mass as a whole. That of the beetle, *Calligrapha bigsbyana* (Hegner, 1910) loses as much as 50 per cent of its wet weight while that of the silkmoth (Tichomiroff, 1885) loses more than 10 per cent of its weight during development. The loss in mass includes dry substance as well as water. It is thus evident that the energy required for maintenance and chemical synthesis is considerable. The amount of energy (expressed in kgm. Calories) utilised per gram of weight during development is approximately the same in both silk-moth and chick em-

bryos. Tangl thus pointed out that the energy required for development is not a function of the phylogenetic position of the animal. Tichomiroff observed that the daily decrease in weight of the silkmoth egg is directly proportional to the extent of morphological differentiation undergone. He as well as Tangl (1909) thus believe that morphogenesis requires a utilisation of organic materials for energy. Such a concept is very probably erroneous.

TABLE II.

The status of phosphorus throughout the embryonic life of the sand-crab, *Emerita analoga*

(Results in mgm. per gm. dry weight).

Stage	Total P (indirectly determined)	Ether-soluble P.	Inorganic water-soluble	Pyrophosphate P.	Stable organic water soluble P.	Phosphoprotein P	Nucleoprotein P.
1	11.62	3.27	2.24	1.55	3.26	trace	1.26
2	11.65	2.94	1.59	2.70	3.16	none	1 25
3	11.10	2.14	2.33	1.26	3.88	none	1.50
4 and 5	11.40	1.83	2.60	2.31	3.06	none	1.59

Stage 1.—Undeveloped end, cleavage stages.—Diam. of egg 0.462 mm., Pale yellow yolk cells.

Stage 2.—Diam. same; eye spots bigger; less yolk.

Stage 3.—Diam. 0.462 to 0.534 mm. Embryo curled around yolk and much bigger; eye spots now almost black.

Stage 4.—Diam. 0.6 mm. entirely filled by the larva and its appendages.

Stage 5.—Larva just hatched.

According to Tichomiroff (1885) and Wester (1910), the eggs of Arthropods have no chitin. On the other hand, the Iowa School (Williams, 1933; Slifer and King, 1934; Jahn, 1935; Slifer, 1937), which has made a thorough study of the egg shell of the grasshopper, *Melanoplus differentialis*, has found that the thick white inner layer, or cuticle (secreted by the serosa), contains chitin although Schulze's diaphanol-zinc-chlore-iodid test was never positive. The crucial alkali-iodin-sulfuric acid test (cf. Campbell, 1929) was positive. The outer layer, or chorion (secreted by the follicular cells), of the shell was found to contain protein but the cuticle was protein-free. The cuticle continues to be secreted after hatching, is the main protective layer of the egg shell, and is largely re-absorbed after blastokinesis (Williams, loc. cit.). Tichomiroff had noted the silkmoth egg to be rich in sulfur. The egg shell of the moth, *Lymantria dispar* (Rudolfs, 1926)

contains 16.15 per cent total nitrogen, i.e. the amount true for proteins in general. There was a detectable amount of glycogen but entirely no fat, cholesterol, or sugar.

H. — Mineral Requirements and the Invasion of Freshwater by Marine Organisms.

It seems very probable that the reason so many groups of animals flourishing in sea water have not established themselves in freshwater is because of an inadequate installation of inorganic salts in the eggs of the former during oogenesis (Needham, 1930). W. J. Sollas (1883) believed that freshwater animals must either be sessile and fixed to a substratum, as in freshwater hydras, or else strong enough to withstand and make headway against the currents. The absence of eggs and larvae from freshwater plankton was thus pointed out. E. von Martens (1858) believed that « penetration into freshwater is checked by difficulties of adaptation to extremes of environmental factors ». That the standpoints of both these authors are inadequate is shown by the fact, pointed out by Needham, that cephalopod molluscs cannot multiply in freshwater even though they hatch out as almost miniature adults. Needham remarked that the eggs of freshwater forms are larger than those of their marine relatives. Thus, a crayfish (one quarter the length of a lobster) lays eggs of actually larger size than those of its marine relative, the lobster. The shrimp, *Palaemonetes microgenitor*, lives in sea water and lays eggs 0.5 mm. in diameter; *P. macrogenitor*, on the other hand, lives in freshwater and lays eggs as great as 1.5 mm. in diameter. The shrimp, *Leander longirostris*, while often normally as much in freshwater as in sea water goes to the sea and lays its eggs, which will not develop in freshwater. Now, the eggs of marine invertebrates are very dependent upon the saline medium. Needham hence suggested that, in the acquiring of the capacity to live permanently in freshwater, the provision of sufficient minerals in the egg may occur as a sudden mutation. The only material with which the egg of marine invertebrates is inadequately supplied by the parent is the inorganic salts.

It should of course, be borne in mind that marine forms incapable of living in freshwater during post-embryonic life are checked from this environment by factors besides those in the egg, namely, the inadequate maintenance of a normal osmotic equilibrium of the body fluids in such a habitat.

I. — Excretion

The eggs of reptiles, birds, monotreme mammals, and terrestrial arthropods have all the material that the embryo requires for development with the exception of oxygen. The eggs of many birds do, in fact, contain a certain,

though inadequate amount of air. These eggs are shut off from their surroundings by a shell which is, however, in the case of probably most arthropods, permeable to water (pp. 102 and 110), and gases, and in the case of reptiles and birds, permeable to gases. In terrestrial eggs the nitrogenous wastes cannot be voided to the exterior and hence must remain within the egg. The elimination of gaseous nitrogen from the egg does not occur, as has been shown by Farkas (1903) on silkmoth embryos as well as by others.

Needham (1929) has called such eggs cleidoic (*cleidos* = shut off, Gr.) to contrast them with a typically non-cleidoic egg, such as that of the sea urchin, which is dependent, for its oxygen as well as for its water and inorganic salts, to the exterior and *the nitrogenous wastes of which diffuse to the exterior*. There are intermediate eggs, such as those of fish and amphibia, which depend upon the exterior for their oxygen and water but not for their ash. The mammalian embryo is in fact an aquatic organism since it has available, practically speaking, an unlimited water supply. While the eggs of some insects will develop normally in a completely dry atmosphere others require a certain amount of humidity or else perish owing to desiccation. This by no means implies that the eggs of such insects are directly dependent upon the exterior for the water they contain, though it shows that they are dependent upon the environment for the prevention of the loss of water which they had already been provided for. The eggs of no animal, so far as known, are dependent upon the surroundings for organic material.

The embryos of silkmoths (Farkas, 1903) give off no nitrogen and assimilate none. The only atmospheric gas utilised is oxygen.

The evolution of the cleidoic egg has, according to Needham, involved far-reaching metabolic changes which are as follows:

(1) The excretion of nitrogenous wastes mainly as uric acid (uricotelic metabolism), a comparatively insoluble and indiffusible substance in neutral or faintly acid media. Non-cleidoic eggs yield urea and ammonia as their main nitrogenous wastes. It should be noted, however, that, in the silkworm egg at least (Manunta, 1934), quite the major component of the uric acid is derived from the female parent and is not a result of embryonic metabolism.

(2) The utilisation of markedly less protein than non-cleidoic eggs (p. 117) and thus reducing the amount of nitrogenous excretion to a minimum.

(3) The greater utilisation of fatty acids (p. 115) than non-cleodoic eggs. These yield a maximal amount of metabolic water when oxidised. It should be pointed out, however, that uric acid is not the only form of nitrogenous waste in insect embryos. Thus the developed eggs of the moth, *Malacosoma americana* (Rudolfs, 1926), contain very detectable amounts of urea and a very slight quantity of ammonia nitrogen.

The capacity of an embryo to synthesise nuclein depends upon whether

or not the type of protein degradation, of which it is capable, is uricotelic. Thus, in the non-cleidoic embryo of the crab, *C. maenas* (Needham and Needham, 1930), there is only a slight synthesis of nucleoprotein P, i.e. of nuclein, while the non-cleidoic embryo of the brine « shrimp », *Artemia salina* actually loses nuclein, as the following data show :

Embryo	Nuclein P in % of total P.	
	Undeveloped egg	Finished embryo
Aquatic (non-cleidoic):		
Carcinus maenas	10.8	13.9
Artemia salina	37.9	27.4
Terrestrial (cleidoic):		
Hen (after Plimmer and Scott)	1.9	27.2

Now, as they pointed out, only terrestial, i.e. cleidoic, eggs, such as those of reptiles, birds and insects, excrete waste nitrogen mainly in the form of uric acid (uricotelic metabolism). Uricotelic embryos, therefore, require purine bases for development and maintenance to replace that lost in the formation of relatively large amounts of uric acid. It is thus evident why existent uricotelic embryos synthesise nuclein, and are the only embryos to do so to any appreciable extent. They also pointed out that the synthesis of the purine ring is probably difficult and hence indicates why mammals, in returning to urea excretion after the uricotelic metabolism of the reptile from which they descended, lose the power of synthesising nucleins. While this view of Needham and Needham wavers around the truth, it fails to take into account the fact that the most of the uric acid formed by animals which undergo a uricotelic type of metabolism form uric acid as the outcome of the degradation of *all* their proteins and not, as in non-uricotelic forms, solely from the degradation of nucleo-proteins (v. Fürth). Accordingly, the loss of nuclein (from the nucleo-proteins) in both classes of animals is equal and the formation of uric acid in those with a uricotelic type of metabolism need not imply a drain on the nuclein content of the animal. It is, therefore, infinitely more plausible to consider that *the capacity of animals which undergo a uricotelic metabolism to synthesise nuclein material, and therefore purine bases, is associated with the fact that they transform all or most of their proteins to the purine derivative, uric acid*, and not because they must replace the nucleins which the Needhams assumed to be lost in the formation of uric acid.

Apparently, due to an irreversible type of chemodifferentiation, the protein metabolism of the post-natal animal very closely resembles that of the embryonic organism from which the animal developed.

J. — Sex

Among the terrestrial arthropods, in the insects at least, sexual determination and sexual differentiation is determined solely by the chromosomal constituency of the nucleus so that the physiology of sex may be appropriately treated in this chapter.

The bodies of most multicellular animals include organs in which cells are produced which when fully developed can give rise, if of the female type, to new individuals. Each such cell is known as a gamete or « germ ». Each species of animal often contains two types of gametes. One, the egg, is relatively large and often contains comparatively large quantities of yolk in its cytoplasm. The other type of gamete is usually much smaller and, when mature, often has a locomotor organ, or flagellum, by which the gamete can be propelled through liquids. This gamete is the spermatozoon. In most of the known multicellular animals and in all normally occurring arthropods each type of gamete is formed and enclosed in a particular form of a given species known as a sex. The form producing eggs is the female sex and that producing the spermatozoa is the male sex.

In certain animals, such as earthworms, both types of gametes are evolved in a single individual. Such animals are termed hermaphrodites, or monoecious, to distinguish them from animals in which the two different types of gametes are produced in two distinct sexes. The latter category of animals it constituted of dioecious organisms, i.e. forms in which the two types of gametes are produced in two separate houses. In 1772 John Bladh declared that « no hermaphrodites have as yet been found among insects ». This statement stands up to this day.

The production of a new individual is ordinarily initiated when a spermatozoon nucleus penetrates the egg and fuses with the egg nucleus. In many cases reproduction occurs when the eggs mature without the action of a spermatozoon. Development not produced by the action of a spermatozoon is known as parthenogenetic. Since the spermatozoon is extraordinarily diminutive relative to the egg and in view of positive results in the artificial production of parthenogenetic development (p. 136), it is safe to conclude that all that the spermatozoon imparts to the egg is the stimulus to develop and the hereditary constitution of the male parent. The egg is the essential gamete in reproduction.

(1) The determination and differentiation of sex. — The chromosomal constituency in a dioecious animal determines the sex of the individual, though, at least in vertebrates, not necessarily irrevocably. There are a pair of chromosomes in the nucleus of each cell of the body which are known as sex chromosomes to distinguish them from the other chromosome pairs or « autosomes. » In many insects, such as the fruit-fly, *Drosophila*, both sex chromosomes are alike in the female. In the male fly, one chromosome of

the sex pair is like those of the female and the other is either absent or different in shape. In such cases the female sex chromosomes are designated as XX and those of the male as XY (when a pair is present) or XO (when only a single one is present). There are cases, such as in the moth *Lymantria dispar*, in which the conditions are reversed so that the sex chromosome pairs in the male are alike (XX) and those of the female dissimilar (XY). Proof that these chromosomes are the sex determining agents comes from breeding experiments combined with cytological studies in which it has been demonstrated that all sex-linked factors, or genes, are contained in these chromosomes.

During the reductional division of the gametes the chromosome pairs split apart, one going to each daughter cell. The mature gametes thus have a single chromosome of each pair. During fertilisation, when the male and female gametes fuse, the paired, or diploid, condition is restored and the sexes established by the random fusion of spermatozoa and eggs.

In certain Hymenoptera, such as bees, unfertilised eggs produce the males, i.e. the drones, and the fertilised eggs the females, i.e. the queens and workers. The chromosomes in the body cells of the males of these animals are thus unpaired and known as haploid in contrast with the paired, or diploid, chromosomes in the body of the females. No special sex chromosomes have been distinguished in such animals, their sex possibly being determined by whether all the chromosomes are haploid or diploid. It is, however, also very possible that there is a special pair of sex chromosomes in the females and only a single such chromosome in the male. That this is probably the actual condition is shown by the fact that drones are occasionally produced from fertilised eggs and females from unfertilised eggs, the latter circumstance being presumably owing to non-disjunction of the XX-chromosomes during the reduction division of maturation (Goldschmidt, 1917 and 1923). The normal condition in honeybees (the cells of the males of which contain 16 chromosomes and those of the females 32 chromosomes) can thus be expressed in the following manner:

Male	Female
15+XO	30+XX

Probably by a reflex control of the sperm pump at the orifice of the spermatheca (Fabre, 1890; Adam, 1901; Breslau, 1905), the queen bee makes the existence of male bees an actual occurrence, for otherwise it seems that all the eggs would be fertilised and accordingly produce nothing but females. Natural parthenogenesis in the production of honey-bee males was first recorded by Aristotle in his « *De Generatione Animalium* » but first definitely proven by Newell in 1914.

By mating together European and Japanese races of the moth, *Lymantria dispar*, R. Goldschmidt (1931) obtained various grades of intersexual offspring in the external and internal genital organs of the daughters, and in the general bodily form and color.

Intersexual forms have been found in other species of insects, in Crustacea, and in vertebrates. It is thus evident that the determination of sex is not an all-or-none type of phenomenon. Goldschmidt was led to believe that the role of the sex chromosomes in determining to which sex an individual shall belong is in causing conditions to develop in one direction, i.e. in upsetting the balance in one direction. Since the Y chromosome is a genetic blank and since sex can be determined by the presence of only a single X chromosome, as in the XO condition, it is evident that in intersexual daughters of *Lymantria dispar* the tendency towards maleness is produced by some duplication of the qualities pertaining to the X chromosome, for, as has already been pointed out, the XX condition in *Lymantria* results in maleness. In other words, in cases in which the sex chromosomes of the two sexes are XX and XO, XX together may be considered to upset the balance in the direction of one sex, while X alone produces the opposite sex.

In insects, both the determination and differentiation of sex is confined solely to the nucleus. In vertebrates, hormones are essential for the differentiation of sex, i.e. for the production of the secondary sexual characteristics of a particular sex. The manufacture of a particular hormone, that is, whether the hormone be of the male or female type, depends, nevertheless, upon the chromosomal constitution of the nucleus. But experimental complete reversal of the « determined » sex of a vertebrate can be induced without alteration of the sex chromosomes. « In the plenomena of sex differentiation », remarked Lillie (1932), « we have two major mechanisms in the animal kingdom. In the case of the first, best known in insects, . . . the mechanism of sex determination is believed to act also as the mechanism of sex differentiation throughout the life history ; there is apparently a complete or almost complete absence of control of sex characters by any extra-nuclear mechanism . . In the case of the second, best known in the higher vertebrates, the mechanism of sex differentiation is taken over by extra-cellular agents, the male and female hormones ».

The sex hormones of vertebrates are secreted by interstitial cells of the gonads (testes and ovaries). Upon removal of the gonads, i.e. castration, of a vertebrate prior to the development of the secondary sexual characters, these characters never develop. In insects, on the other hand, castration does not alter or interfere with the development or maintenance of the secondary sexual characters so that the asexual condition among these forms is not known since, as Lillie pointed out, the sex genes have never been eliminated completely.

We shall now examine the evidence which shows that sexual hormones

do not occur in insects and that both sexual determination and sexual differentiation are irrevocably stamped by their sex chromosomes. In 1910, Wheeler, among the entomologists, observed that the sexual differentiation of an insect cannot be altered or even modified. Extensive castration and gonad transplantation experiments were carried out by Kopec (1911 and 1913) on various Lepidoptera (*Lymnantria dispar*, *Malacosoma americana*, *Pieris rapae*, *Vanessa io*, and *Gonepteryx rhamni*) with similar results in all species. The castration of a larva, irrespective of age and sex, produced hypertrophy but not a change in histological structure of the remaining gonad. The testes, implanted in the abdomen of a castrated female larva of the same species, hypertrophied but differentiated as a testis. This is apparently due to the greater space provided. The testis will develop as a testis in a non-castrated female larva too. An ovary implanted intra-specifically in the haemocoele of the abdomen or thorax of a castrated or uncastrated male larva will develop into a histologically normal but smaller ovary in which the yolk bodies are, however, smaller than normal apparently owing to the lesser amount of fat in the male. Gametogenesis proceeds as is normal for the transplant. In no case did the transplants have any influence on the secondary sexual characters of the hosts. The experiments demonstrate the entire lack of sex hormones in the haemolymph for, in vertebrates, such heterosexual transplants would produce an alteration in the histological dif-

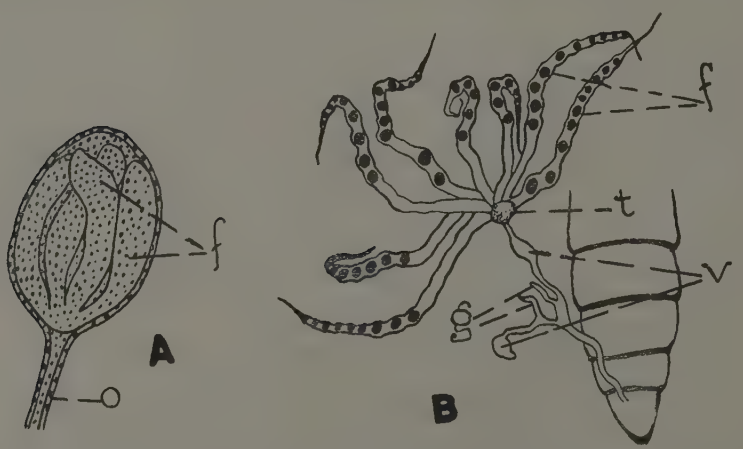

Fig. 17. — A. Ovary of the third larval instar of the moth, *Lymantria dispar*, as it normally appears; 48 X. — B. Abdomen of a male adult moth from which one of the two testes had been removed during the third larval instar and then replaced by the ovary in A; 3 X. — *g*, male accessory glands; *f*, ovarian follicles; o, oviduct; v, vasa deferentia. — (After Meisenheimer).

ferentiation of the gonad transplanted towards that proper for the sex of the host. Interspecific transplantation in insects resulted in a degeneration and final absorption of the transplant. This might be expected due to the introduction of foreign proteins.

A half castrated or wholly castrated larva in which the blood of the opposite sex had been injected nevertheless developed with all the secondary sexual characters of its own sex. Castration produced no effects on the subjects, even when performed soon after the first larval molt, apart from local effects or permanent damage from the operation.

Kopec's work is chiefly a confirmation of that of Crampton (1899) on various moths, of Oudemans (1899) on *L. dispar*, of Kellog (1904) on *Bombyx mori*, and of Meisenheimer (1907 and 1910) on various species of Lepidoptera (*Lymantria dispar, L. japonica, Porthesia similis*, and *Vanessa urticae*). In fig. 17 B is shown the abdomen of a male adult moth, *Lymantria dispar*, from which one of the two testes had been removed during the third larval instar, when in an embryonic condition and when the animal had not undergone any apparent sexual differentiation, and was replaced by the ovary of a third instar larva (fig. 17 A). It will be noted that, in the male adult, the ovarian transplant is fully developed.

Portions of moth pupae (Crampton, 1899), with as yet unpigmented scales, were coalesced together by paraffin. Mortality was great and, in the cases in which adult emergence occurred, only the integument of the two portions had fused. What is, however, significant at this point is that each part produced the specific wing coloration of its own sex. This further shows that sexual differentiation in insects is not influenced by extracellular substances.

Kopec (1922), however, believed that Crampton's experiments were inconclusive because carried out at a late stage in pupal development when the factors determining the production of pigment had already become established. Kopec thus carried his experiments on sexual dimorphic wing coloration back into the larval stages. Grafting wing rudiments of larvae of the moth, *Lymantria dispar*, from the larva of one sex into that of the opposite sex resulted in the rudiment differentiating according to the sex of its donor and not according to that of its host. Crampton's conclusions were thus fully confirmed.

Working with the domestic fly, Geigy (1928) found that all the structures of castrates are formed exactly as in non-castrates of the same sex, i.e. the secondary sexual characters developed completely. It is noteworthy that *Geigy castrated flies by extirpating the germ cells at their very inception, that is, when in the posterior end of the blastoderm.*

Removal of the gonads from larvae of the silkmoth, *Bombyx mori* (Hamasaki, 1932), resulted in an apparent prolongation of the life dura-

tion of the pupal and adult stages and in an accumulation of fat to three times its normal content. The weight of the cocoon and of the pupa of larvae which had been castrated invariably excelled those of non-castrated larvae. It seems evident, therefore, that the growth of the gonads is a drain on the energy sources of the individual.

In the Crustacean, *Daphnia magna* (Mori, 1933), as in insects, sexual differentiation appears to be due solely to intracellular agents. The undifferentiated germ cells of young third instar larvae were destroyed by the beta electrons ejected from radium. Since the animals were placed in water in a small glass vessel when irradiated, the effects could not be due to the alpha emanations from radium, for, these will not even pass through a thin sheet of glass and only through 32 μ of water. The dosage which produced germ cell degeneration did also produce a certain amount of injury to the hypodermal and gut cells. The dosage, however, could be so adjusted as to bring the animals to the sexually mature form with entirely no gonads. The secondary sexual characters of adult males so treated in the larval stages (such as the structure of the antennulae, first legs, anal appendages, type of carapace, and body as a whole) were quite as in non-castrated normal male adults. In the females, only the brood chamber was undeveloped. But necessary factors for producing the brood chamber are the ovaries and these are, of course, absent in castrated females.

Decapod Crustacea differ markedly from insects and apparently from cladoceran Crustacea. Among decapods, as in vertebrates, sexual differentiation has been found to depend upon extracellular substances (hormones ?) liberated form within the gonads. The effects of the parasitic castration of crabs (cf. Smith, 1910-1913 and 1915) by the rhizocephalous cirriped, *Sacculina*, were first observed by Giard. « The male (castrated) crabs have a much broader abdomen, reduced styles (these may disappear altogether), and abdominal swimmerets (which carry the eggs in the female, and are absent in the normal male). There is, in short, a marked tendency to the female type. In the female crabs there is also a change, but this is held to be not towards the male but towards the juvenile type ». I would rather say, however, that in both cases the tendency is, as in vertebrates, not to the type of the opposite sex but to juvenile condition. In a preliminary communication, Darby (1935) asserted that the development of the snap-claw in the shrimp, *Crangon armillatus*, was found to consist in the modification of the pinch-claw generated by a sex hormone. An unexpected fact is presented by the large cheliped of the male fiddler crab, *Uca pugnax* (Huxley, 1931), a secondary sexual character, which has a lower growth coefficient when the gonads begin to function than before they function. This may, however, be due to the limitation of food materials caused by the growth of the gonads.

(2) Gynandromorphs. — In 1730, Nichols gave an account of,

what he termed, a « hermaphrodite » lobster which he had presented to the Royal Society of London. The parts proper to the female were found only on the right side; those to the male only on the left side. This applies to the external characters as well as to the internal genital organs. « The plates covering the tail were extended on the right side considerably below the surface of the tail, and were edged with thick and long hair, and terminated broadly as in females. On the left side these plates were much less extended below the tail; were almost totally void of hair, and terminated in acute angles » as in males. Such an individual is strictly speaking, not a hermaphrodite but a gynandromorph. The latter is a sex mosaic which has been shown to result from an unusual disturbance in nuclear division during development. A hermaphrodite, on the other hand, is not a sex mosaic, since all its somatic cells are identical in nuclear genetic constitution. The gynandromorph described by Nichols happens to be bilaterally symmetrical. There have been described, however, all sorts of combinations of sex mosaics down to merely a gynandromorphic condition confined to the internal sexual organs. Even in this last case the difference between gynandromorphism and hermaphroditism does not vanish, for, the somatic cells of the male and female reproductive organs of the gynandromorph differ in nuclear constitution (see below) while those of a hermaphrodite probably do not. It should be remembered that a hermaphrodite may be a monosexual individual while a gynandromorph is an abnormal condition in a normally bisexual species.

Chances for the occurrence of gynandromorphism are possible with each cell division so that it is not surprising that the phenomenon is quite common and, in certain cases, of regular occurrence. The instances placed by Goldschmidt (1923) under « non-functional hermaphroditism » are probably cases of gynandromorphism since they occur in bisexual species, i.e. in animals in which the chromosomal constitution of the body cells are dimorphic thus producing males and females. Among such examples is that of the male cockroach, *Blatta germanica*, the sex organs of which may be differentiated, to a slight extent, toward the female direction. Thus, in many cases rudimentary oviducts are formed and egg cells begin to develop. In the amphipod, *Orchestia*, a part of the testis always contains eggs, and in the crab, *Gebia major*, the testes are always differentiated into a posterior part containing non-functional eggs. Within the ovary of the freshwater crab, *Potamobius fluviatilis*, and the branchioped, *Apus*, there is often found sperm tissue and vice-versa.

It has been shown by breeding experiments and cytological studies that the production of bilateral gynandromorphism in *Drosophila* is because, owing to some abnormal disturbance in nuclear division during embryonic development, one half of the body (the male half in this case) comes to have one X-chromosome while the other half possesses two X-chromosomes. Sometimes,

as shown in crosses between races (such as in the silkworm), the whole nucleus must have taken part in the abnormal division and not merely the sex chromosomes (cf. Goldschmidt, 1923).

It is easy to realise how a state of gynandromorphism can exist in insects — animals in which we know that sexual differentiation is solely due to intracellular agents and not to extracellular substances liberated into the blood stream. Sexual differentiation in crabs, as in vertebrates, is, on the other hand, determined by substances liberated into the blood from the gonads (p. 128). If this is also true for the lobster, which, like the crab, is a decapod crustacean, an explanation would be necessary for the pronounced gynadromorphism described by Nichols. In vertebrates, undoubtedly owing to the presence of sex hormones in the blood, gynandromorphism is never as pronounced as it in insects. The existence of gynandromorphism in animals which secrete sex hormones into the blood can be explained either by supposing that sexual differentiation, as produced by solely intracellular agents, takes place before the release of sex hormones into the blood, by supposing that there is an annuling effect of the hormones of both sexes in the blood, and, when only gonads of one sex are present, by considering that the hormone fails to upset the balance in the direction of that of the sex proper for the gonads. All these suppositions are purely hypothetical.

(3) Hermaphrodites. — In certain species of animals, such as earthworms and flatworms, the male and female gonads are both produced within the same individual, though not necessarily at the same time. In such animals sex may or may not be present and cross-fertilisation may or may not occur depending upon the species. Thus, the earthworm and flatworm have no sex. Earthworms, however, are cross-fertilised but flatworms, such as the tapeworm, are not. Certain nematodes pass through a hermaphroditic stage when parasites but are bisexual in the free-living interval. It is thus easy to discover that the nematode hermophrodite is really a female, i.e. that hermaphroditism is gynomonoecious or pertains to the female sex. The hermaphrodite in this case produces two types of spermatozoa of which only one is capable of fertilising the eggs. Instances of andromonoecious hermaphroditism also exist.

There are only a few cases of hermaphroditism known among arthropods and these only among the Crustacea. Cross-fertilisation is insured by consecutive hermaphroditism as in certain isopods in which each individual is a male when a free-living larva and copulates with the parasitic female. The larva then attaches itself to a host and becomes transformed into a female. This is accomplished by a disorganisation of the male gonads and the development of the female gonadal fundaments. Certain cirripedes, such as *Scalpellum peronii*, have testes and ovaries in the same individual and at the same time.

(4) The germ plasm. — August Weismann believed that the germ plasm is a distinct entity apart from the somatoplasm, or non-gonadal constituents of an organism, and that it is continuous from one generation to another either in the visible form of the germ cells or in an invisible condition. The germ plasm was hence considered to be continuous and thus contrasted with the somatoplasm which is temporary and only lasts as long as its individual possessor. In arthropods with centrolecithal eggs in which the capacity for regulation ceases before or with the formation of the blastoderm, the germ cells are then determined and lie at the extremity of the eggs which is the presumptive posterior end of the animal. Destruction of these cells would result in the production of normal adults were it not for the entire absence of gonads (Hegner, 1908 and 1911). The gonads are not formed from any other region of the embryo. This is, however, true not only for the gonads but for every presumptive structure to be formed from the blastoderm. That is, reconstitution does not take place in such embryos. From a discussion of this subject earlier in the paper it is evident that whether or not gonads will be reconstituted depends upon whether the embryo is capable of reconstitution in general.

Child (1915) does not think the Weismannian dogma of the continuity of the germ plasm necessary. The fact that various embryos are capable of reconstitution into complete though smaller wholes and develop gonads after removal of parts at random and the fact that the sex organs and germ cells of plants appear only when the plant attains a certain physiological condition indicates that the germ plasm, if it is continuous from one generation to another, must be present in all cells (which is absurd) or else not be continuous.

(5) Secondary sexual characters. — The sexual dimorphism, or structural differences between the sexes of a species, will not be treated here since it is amply dealt with by taxonomists. We shall mention solely physiological differences.

Only in rare cases do secondary sexual differences appear as early as the egg. One such instance is in the plant louse, *Phylloxera*, in which the male- and female-producing eggs differ in size. Differences in color and structure are often present in the larval and pupal stages of both exopterygote and endopterygote insects. Clare (1925) could not find any differences in the rate of oxygen consumption of male and female pupae of the fly, *Drosophila melanogaster*, under identical conditions (Eddy, 1937, and Orr, 1937, have, however, found that female adult *Drosophila* have a higher rate of metabolism than the males. Poulson, 1935, and Dobzhansky and Poulson, 1935, found that the rates of O_2 consumption and CO_2 output are greater in male than in female pupae of *D. melanogaster* and *D. obscura*) ; and Frew (1929) stated that three is no reliable evidence indicating differen-

ces in the rate of metabolism between male and female blow-flies (*Lucilia*, etc.). Taylor (1927), also found no differences in the rate of oxygen consumption between male and female pupae of the blow-fly, *Phormia terranovae* Taylor and Steinbach (1931) and Crescitelli and Taylor (1935), on the other hand, observed that male pupae of the bee moth, *Galleria mellonella*, have higher rates of metabolism during approximately the first 150 hours of pupal life, while during the remaining approximately 40 hours (temp. 30°C.) the females had significantly higher rates. Considering the whole of pupal development, the male pupae consumed more oxygen and liberated more heat per unit weight than did the females (Crescitelli and Taylor (1935). They suggested that these sexual differences may be due to differences in the amount of respiring tissue present at comparable times rather than due to a sex difference in basal metabolism. The male pupa of the silkmoth, *Bombyx mori* (Farkas, 1903), begins with a little higher caloric potential and utilises more energy during development than does the female pupa.

Both pairs of wings of a male butterfly, *Pieris brassicae* (Wigglesworth, 1924), contain 0.5 mgm. of uric acid while in the female the uric acid content of the wings is 0.3 mgm. This difference is due to the larger wing scales of the male since uric acid and its derivatives form the white and yellow pigments of the wings of pierid butterflies. The uric acid content of the pupa of the moth, *Deilephila euphorbiæ* (Heller and Aremowna, 1932), was, at the beginning of pupation, 19.4 per cent of the total solids in the male but 13.0 per cent in the female. The content of nitrogenous material in the male excretion at the time of emergence was also significantly greater than that of the female. This indicates that the greater amount of uric acid present in the male pupa of this species is not utilised in the formation of pigment. In fact, uric acid derivatives have been found to form wing-scale pigments only in pierid lepidoptera (Hopkins, 1895a, b). The excretion (meconium) of adults of various moths (*Attacus pernyi*, *Saturnia pyri*, *Sphinx ligustri*) eliminated soon after emergence show no appreciable sex differences (Courtois, 1929).

Since the rates of chemical change and general activity in a poikilotherm vary directly with the temperature, within vital limits, the weights of adult *Drosophila* flies (Eigenbrodt, 1930) vary inversely with the temperature at which they were bred. The males were consistently lighter than the females. There was less structural sexual dimorphism at the lower temperatures than at the high temperatures. For unknown causes, the immature period (egg-larval-pupal) of the female flies was shorter than that of the males at all temperatures used (15.5° to 29.5° C.) and the differences in hatching time between the males and females increased with a decrease in temperature. This cannot be due to a higher rate of metabolism in the

females since Alpatov and Pearl (1929) and Kucera (1934) showed that the female adult *Drosophila* flies have a lower rate of oxygen consumption than the males under identical conditions. McArthur and Baillie (1929) found that female *Daphnia magna* live longer than the males and this very probably implies that the former have a lower rate of metabolism.

Between the times of emergence from the pupa and of the copulation of male silkmoths (Vaney and Maignon, 1905), there is a diminution of glycogen and a pronounced increase in fat as well as an increase in protein. In female moths the reverse is true but this difference cannot be due to the deposition of fat and protein in the eggs as stores for embryonic nourishment, for, the developing eggs were included with the analyses. After copulation there is a decrease in the concentration of fat but an increase in that of glycogen in both sexes. Glycogen is stored in the fat-body.

TABLE II

Sexual differences in the chemical constitution of male and female silkmoths

(Results in gms. per 10 individuals minus cocoons).

STAGE	GLYCOGEN	FAT	PROTEIN
Silkmoth pupae (near time of emergence)	0.069 (male) 0.069 (female)	0.225 (male) 0.316 (female)	0.021 (male) 0.170 (female)
Copulating	0.023 (male) 0.117 (female)	0.511 (male) 0.268 (female)	0.063 (male) 0.045 (female)
After copulation and egg laying	0.888 (male) 1.300 (female)	0.086 (male) 0.064 (female)	—— ——

Even as early as the larval and pupal stages, there is a sexual difference in the tyrosinase activity of the blood of the silkmoth *Bombyx mori*, that of the males darkening more rapidly upon exposure to the air (Geyer, 1913). Steche (1912), also, has noted sex differences in the blood.

We have already noted that vitamin E is necessary for the fertility of female honey-bees but not for that of the drones, i.e. males (Hill and Burdette, 1932).

(6) Parthenogenesis.

(a) Natural Parthenogenesis. — It has already been pointed out that the males of social Hymenoptera issue from unfertilised eggs. Development from unfertilised eggs is parthenogenesis. The spermatozoon may thus generally be considered to confer on the egg solely the

stimulus to develop and the hereditary constitution of the male parent. The egg supplies the nutritive material for development and is, therefore, essential. Since drones arise from unfertilised eggs they bear the hereditary factors of their grand-fathers.

Parthenogenetic or unfertilised eggs may be divided into the following groups depending upon the sex or sexes produced by parthenogenesis :

(1) *Arrhenotocous* (*arrhen* = male ; *tikto* = bear ; Gr.), in which parthenogenesis normally results solely in the production of males. e.g. social and chalcid Hymenoptera.

(2) *Thelytocous* (*thely* = female, Gr.) in which parthenogenesis results, except at occasional intervals, in the production of females, e.g. aphids or plant lice, the phasmid *Dixippus*, many Branchiopoda and Ostracoda.

(3) *Ampherotocous*, in which parthenogenesis results in the production of both sexes. Among arthropods, examples of this category are the aphids and daphnids, which produce parthenogenetic males under certain conditions. These eggs are thus successively thelytocous and arrhenotocous.

(i) *Hexapoda.* — In various wasps (*Neuroterus lenticularis* and *Rhodites rosae*), in chalcid bees, in social and in certain tenthredinid hymenopterous males arise solely (except in abnormal cases, see p. 124) from unfertilised eggs, only one kind of spermatozoon being formed since the reduction division is aborted at least in the honey-bee (see Meves, 1907). The nuclear mechanism of sex determination has been described above (p. 123). The chalcid bees, *Entedon xanthopus* and *Pentarton carpocopsae* (Vassilieu, 1908), produce males from unfertilised eggs and females from fertilised eggs. The unfertilised eggs of aphids (*Phylloxera* sp.) produce parthenogenetic females and, at times, parthenogenetic males (see Goldschmidt, 1923). The males in these species too are, in fact, never produced from fertilised eggs. Thus, in the male-producing eggs, one X-chromosome enters the polar body without splitting, i.e. without reduction, and hence the male has the XO number of sex chromosomes. The fertilised eggs yield only females because the male-determining spermatozoa, that is, those without the X-chromosome, fail to live.

Parthenogenesis has also been observed in the thysanopteron, *Anthothrips verbasci* (Shull, 1914).

The phasmid, *Dixippus morosus* (de Baillon, 1926), reproduces parthenogenetically in both Europe and India. In India, however, it is only facultatively parthenogenetic but in Europe no males of this species have ever been found. In fact, certain external copulatory structures are absent from the European variety so that copulation with males imported from India was not possible. In India, parthenogenesis is the outcome of a diminution of males while in Europe it is the result of a deficit in the external structures of the female organs of copulation.

Occasional parthenogenesis has been observed in the gypsy moth, *Lymantria dispar* (Goldschmidt, 1917), and this results in the production of both sexes. The parthenogenetic mother was a first filial hybrid between a European and a northern Japanese race of the moth. No reduction division had apparently occurred during maturation, for, the oogonia and spermatogonia of the parthenogenetically produced individuals had the normal diploid number of chromosomes. An actual study of the maturation divisions was, of course, impossible. Silkmoths also exhibit occasional parthenogenesis.

The female pupae of the midge, *Chironomus* (Miall, 1895), lay unfertilised eggs which develop into adult animals. In autumn, however, the eggs are laid by winged fertilised adult females. Reproduction by immature animals is termed paedogenesis. In the case of *Chironomus*, as in the fly *Miastor*, paedogenesis is parthenogenetic. In amphibia, on the other hand, paedogenesis occurs upon fertilisation, both male and female individuals being in the larval condition.

(ii) *Crustacea.* — Parthenogenesis in the Cladocera (e.g. *Daphnia* and *Simocephalus*) is well known. It also occurs in other Branchiopoda, such as *Artemia*, in the Ostracoda, and the isopods, *Trichoniscus provisorus* and *T. biformatus* (Vandel, 1925). In some ostracods, according to Borradaile and Potts, males have never been found. The occasional parthenogenetic production of males may have the same cytological basis as in *Phylloxera* mentioned above.

(iii) *Intervals of gamic reproduction.* — It has been believed by some (see Goldschmidt, 1923) that the periods when the males are produced by parthenogenetic females occur at regular intervals due to some unknown inherited constitution which produces an increasing tendency toward bisexuality with an increase in the number of generations. A serious blow was delivered to this theory, in 1914, by Banta when he reared *Daphnia pulex* for one hundred parthenogenetic generations under favorable conditions without the production of any males. There was no evidence of decreased vigor or loss of vitality at the lapse of this time. *Simocephalus* (probably *S. vetulus*) was reared for 76 generations in 1 line without the appearance of males.

Mere crowding of *Daphnia pulex* (Smith, 1915) at 27°C. produced no males. But both isolation and crowding at 10° to 17°C. yielded males to a small extent. Under crowded conditions the male production was 7.18 per cent of the total offspring while it was 3.01 per cent under isolated conditions. Working with the aphid, *Macrosiphum solanifolii*, Shull (1930) also found that low temperature tends to produce males. Low temperature and alternating light and darkness applied to the adult winged parthenogenetic females tended to produce male offspring; high temperature and continuous

light, on the other hand, tended to prevent the production of males. Temperature was much more effective than light. Alternating high and low temperatures favored the production of male offspring at least as much as did continuous low temperature. The influence of environmental factors upon whether or not males would be produced is determined before hatching and could not be changed thereafter. Offspring of parents that were exposed to temperature and light conditions having opposite effects on the mode of reproduction took longer to develop than did offspring treated to temperature and light acting in the same direction of the mode of reproduction. It therefore seems that « the opposition of morphogenetic factors acting before birth retarded the rate of development after birth ».

It is thus apparent that the seasonal cycle in reproductive mode, which aphids and cladocerans undergo in nature, is not inherent in the sense of being hereditary but is due to climatic conditions.

(b) Artificial parthenogenesis. — While it is true that Tichomiroff (1885 and 1902) had earlier initiated the development of silkmoth eggs up to the formation of the three germ layers by placing eggs, removed from a virgin silkmoth, for 2.5 minutes in concentrated sulfuric acid and then thoroughly washing them in water, or by mechanical friction, it is, however, known that a small percentage of silkmoths always does develop parthenogenetically. If this were not the case Tichomiroff (1885) would have the credit of being the first person or record to induce artificial parthenogenesis. The first complete parthenogenetic development of a sea-urchin and of a frog egg to the larval stage was accomplished, as to the former, by Loeb (1905) and, as to the latter, by Guyer (1907) and Bataillon (1910). For a treatment of the history of artificial parthenogenesis cf. Loeb (1913), Morgan (1927), and Gray (1931).

The work of Tichomiroff was extended by Kellogg (1907) who dehydrated, to a greater or lesser extent, the eggs of silkmoths by various agents : dry air, sunlight, friction, heat (25° to 57°C.), or concentrated sulfuric acid (applied for 1/4 to 2 minutes and then washed away thoroughly with water), and various other dehydrating processes. He was thus able to increase materially the proportion of eggs developing from unfertilised eggs but not the number of hatchings. Artificial parthenogenesis was therefore, not completely successful since development was not completed. It is, nevertheless, a determined fact that the easiest way to produce artificial parthenogenesis of a sea urchin egg is to place it in hypertonic sea water, i.e. to dehydrate it. The viscosity of the fertilised egg of the sea urchin was shown by L. V. Heilbrunn (1915, 1917, 1920, 1921, cf. 1928) to be greater than that of the egg before fertilisation. An increase in viscosity is thus apparently an essential accompaniment of development.

Experiments on the artificial parthenogenesis of the eggs of arthropods are quite evidently very meager.

K. — Site of Sojourn of the Embryo

In all mammals, except monotremes, the egg contains very little storage material. This, coupled with the fact that mammals are of terrestrial derivation, indicates why the mammalian embryo is nurtured by the blood of the female parent and is not born in a larval condition but in a state having a close miniature resemblance to the adult. According to the site of sojourn and the source of nutriment of the embryo, animals are separated into the following categories :

(1) *Oviparous*, in which the egg is discharged to the exterior, before or after fertilisation, and the embryos thus develop outside of the body of the parent, e.g. fish, amphibians, reptiles, birds, monotreme mammals, and most athropods.

(2) *Ovoviviparous*, in which the embryo develops within the body of the female parent and is deposited in the external world in a post-embryonic stage but derives nourishment solely from the storage material contained within the egg, e.g. various species of flies such as the flesh-fly, some coccinelid beetles, many aphids, scorpions.

(3) *Viviparous*, in which the embryo develops within the body of the female parent and derives its nourishment, largely at least, directly from the blood or lymph of the parent, e.g. all mammals, except the monotremes. Fernando (1934) has noted that the egg of the psocid insect, *Archipsocus fernandi* has no chorium and that the yolk does not seem adequate for nourishment of the embryo. He, therefore, suggested that the embryo derives nourishment from the mother by way of the serosa. He does not, however, state whether such occurs at the expense of the ovarian tissue or directly from the blood.

In 1671, Martin Lister described « a kind of viviparous fly » before the Royal Society of London and said « this is the only fly I have observed with live and moving worms in the belly of it; yet I guess, we may venture to suspect all of this tribe to be in some measure viviparous ». He was unwittingly confounding ovoviviparity with viviparity — an excusible mistake since the same error is committed in up-to-date text books of zoology (see, for instance, Borradaile and Potts, 1932, p. 420).

There are various intermediate grades between absolute oviparity and absolute ovoviviparity even in a single class — the Hexapoda. Thus, in the domestic fly, the zygote nucleus divides (i.e. embryonic development begins) before the egg is laid while in certain dragonflies (examples of absolute oviparity) division of the zygote nucleus occurs after the egg is laid (p. 98).

Most ovoviviparous insects are larviparous (i.e. lay larvae) but some are pupiparous (i.e. lay pupae). An example of pupiparity is given by the horse-fly, *Hippobosca equina*, and the sheep-fly, *Melophagus ovinus* (Lacor-

daire, 1834). The first species is an ectoparasite on the horse, and the second on the sheep.

L. — Insemination and Fertilisation

These are two terms which should never be confused with each other, as is often the case. The first implies solely the introduction of the sperm (spermatozoa and the spermatic fluid) into the body of the female. This is done by an act of sexual copulation. The sperm is usually stored for a time, among arthropods and other animals, in a sac-like growth, or spermatheca, of the reproductive tract of the female. Fertilisation occurs only when the nucleus of the spermatozoon (or male pronucleus) fuses with that of the egg (or female pronucleus) and forms a zygote nucleus with the diploid number of chromosomes. Many animals, such as Amphibia, possess no copulatory organs and insemination never occurs; the eggs being fertilised when extruded to the exterior. As shown by birds, however, specific copulatory organs (possessed by most arthropods) are not the sole means of insemination.

The time interval in which the spermatozoa of various species are known to survive in the female genital tract and yet maintain their fertilising power is, under optimal natural conditions, as follows:

Mouse and rat	8 to 10 hours
Man	About 24 hours
Domestic fowl (*Gallus domesticus*)	24 days
Bat	About 6 months
Cotton Boll Weevil	About 6 months
Honey-bee	About 4 years

The time between insemination and fertilisation has been used, at least in the last three cases, as a measure of the duration of the sperm. This does not, of course, say much as to how much longer the spermatozoa could have retained their fertilising power. The honey-bee queen, even though inseminated only once, continues to fertilise ages throughout its adult life-time which usually last about 4 years (see Snodgrass, 1925). In bats, the females mate probably only in autumn but their eggs are not fertilised until spring. The cotton boll-weevil, *Anthonomus grandis* (Grossman, 1929), was inseminated before hibernation. It laid its eggs 201 days after insemination. The time of insemination, of course, coincides with that of copulation.

Old males of the fly, *Drosophila melanogaster* (Duncan, 1930) fail to fertilise the females even though spermatogenesis continues to proceed in their testes. No sperm was found in the spermathecae of females which had mated to these males during the sterile period of the latter, except in cases

in which double mating had occurred. The impotency of the old males is quite apparently due to a loss of function in the ejaculatory apparatus.

During copulation, mobile forces must occur if the sperm is to be driven from the chambers in which they are stored in the male (seminal vesicles and, to a certain extent, the ejaculatory duct) into the female reproductive tract. The walls of the ejaculatory duct, at its proximal end at least, usually contain transverse and longitudinal muscle fibres. Nonidez (1924) has found that the ejaculatory sac of *Drosophila* acts like a pump and drives the sperm at considerable pressure through the narrow ejaculatory duct. After ejaculation there occurs a pause of 2 to 3 minutes during which the spermatozoa, now in the female vagina, do not display any movement. They then begin to swim actively by means of their flagellar tail and enter the seminal receptacles or spermathecae. Nonidez supposes that the spermatozoa are activated in the female genital tract by a secretion of accessory glands, or parovaria.

The walls of the testes of many (probably most) arthropods contain no muscle fibres. Baumgartner (1930) has noted, however, that the ejaculation of sperm in certain Orthoptera is accomplished, in part at least, by contractions of the striated muscles of the follicles composing the testes and also possibly by the vibratory movements of the tail of the spermatozoa. Very probably the female reproductive tract also undergoes muscular movements during copulation but these, so far as I know, have never been described. Indeed the mobile elements involved in insemination in arthropods are only fragmentally known.

Fertilisation of the arthropod egg generally occurs when it is descending the common oviduct. Owing to the presence of a shell, the spermatozoa can enter the egg cytoplasm solely by way of a small orifice, usually at the anterior end of the egg, known as a micropyle. Fertilisation of an egg is rendered very probable, if not infallible, by the relatively enormous numbers of spermatozoa released and by the thigmopositive behavior of the spermatozoa. The latter property was demonstrated by Dewitz (1885 and 1886) when he formed a suspension of cockroach spermatozoa in a saline solution and placed such under a cover-glass resting on low supports. « The spermatozoa collect at the solid surfaces of the sides and cover-glass while the liquid remains free from spermatozoa ». It was suggested that the thigmopositive reaction of the spermatozoa is very probably an important factor in causing the entrance of spermatozoa into the small micropyle. The spermatozoa would move incessantly on the surface of the egg shell until one would get into the micropyle by chance.

In certain arthropods, such as lobsters (Herrick, 1895), fertilisation occurs after the eggs are ejected to the exterior, there being no copulation.

M. — Fecundity

The number of eggs laid by a given species varies with its nutritive state and with its size. For example, the number of eggs laid by the American lobster (Herrick, 1895) varies directly with the size of the animal. The following table shows that « the numbers of eggs produced by female lobsters at each reproductive period vary in geometrical series while the lengths of the lobsters vary in arithmetical series ».

Approximate length in inches	8	10	12	14	16	18
Approximate number of eggs	5,000	10,000	20,000	40,000	80,000	160,000

When the larvae of the clothes moth, *Tineola biselliella* (Titschack, 1926), had been fed under poor food conditions during the larval period, the absolute number of eggs laid by the adults so produced declined and so did the ratio of eggs laid to the fresh body weight of the female adult. The heavier the female the more the eggs laid and the greater the ratio of the total egg weight to the fresh body weight. The larvae were fed on various types of food and it was found that the poorer the food the greater the amount of food required to yield 1 mg. of eggs.

Nutritive conditions have been known to affect the sex ratio in certain cases. Thus larvae of the fruit fly, *Drosophila ampelophila* (Guyénot, 1917), reared on poor or very dry media result in the formation of adults which are exclusively or almost exclusively males. This phenomenon always corresponds with a high mortality of pupae and may be due to a greater sensitivity of the females, or because the latter, due to egg formation, require more reserve material than the males, or to both these factors. Very similar results were obtained by Herms (1928) on the blow-fly, *Lucilia sericata*. The larvae were removed from food at 6-hour intervals after having fed for 30 hours, the longest feeding period being 96 hours. As the feeding period was increased the sex ratio was reversed to a preponderance of females. Exactly contrary was the effect of extending the feeding peroid of the sex ratio of the mosquito, *Theobaldia incidens*.

Fecundity is also influenced by various temperature-humidity combinations as shown by the work of Weed (1927) on the plant louse, *Mysus persicae*. It is unfortunate that temperature was not isolated from humidity, but both these factors varied directly with each other (temp.: 10° to 28°C; humidity: 60% to 85% R.H.). The fecundity increased up to 24°C. and 75% R.H. beyond which it declined precipitously. The total number of eggs laid by a female homopteron, *Trialeurodes vaporariorum* (Weber, 1931),

attains a maximum at about 27° C. and declines precipitously at temperatures above this.

In one case, that of the bug *Rhodnius prolixus* (Wigglesworth, 1935), it has been demonstrated that adult females deprived of brain plus corpus allatum do not form eggs. When, however, only the corpus allatum is left intact in the body and the brain is removed, normal egg development results. Blood from females with a corpus allatum will induce egg development in females from which this organ has been removed. The effects of the egg forming hormone secreted by the corpus allatum are not even genus-specific, for, they can be produced in *Rhodnius* by the hormone of the allied genus *Triatoma*. The egg-forming hormone secreted by the corpus allatum is quite distinct from the molting hormone secreted by the same organ since the molting hormone (of the larvae, of course) will not induce egg formation; nor will the egg-forming hormone initiate molting. The oenocytes, too, seem to be connected with egg-formation — possibly with the synthesis of the egg shells.

N. — Effects of Radiations

The various types of radiations, of which visible light occupies but a very small range (Table III), have at least one property in common, namely, an equal speed of propagation. This is approximately 3×10^6 cm. per second. The radiations extend through an enormous range of wave lengths ranging from the electrical waves used in wireless telegraphy and radio, the wave lengths of which are so long that they are usually expressed in meters, to the cosmic rays, the wave length of which are measured in Angstrom units ($1\ \mathring{A}.u. = \frac{1}{10{,}000}\ \mu$ or $\frac{1}{10{,}000{,}000}$ mm.). Beyond the cosmic and the electrical waves may exist other radiations of which we know nothing.

Studies on the effects of radiations on the growth, development, and activities of arthropods has, in some cases produced results of significant importance in our knowledge of the physiology of these animals. In the field of genetics, X-radiation has been used to modify the frequency of crossing over and of non-disjunction of the chromosomes during the maturation of the gametes of the fruit-fly, *Drosophila*. Headlee's work on the destruction of insects by radio (p. 142) seems to promise fruitful control of insect pests by this method but still awaits further investigation.

Under this topic, for the sake of convenience, the effects of radiations on all stages of an arthropod's life will be treated.

TABLE III

RADIATION	WAVE LENGH IN CM.
Electrical radiations	1×10^{5} to 2×10^{-2}
Infra red:	
Longest heat waves	3×10^{-2}
Infra-red down to	7×10^{-5}
Visible radiations (light):	
Limit of red	7.2×10^{-5}
Yellow	5.8×10^{-5}
Green	5.0×10^{-5}
Blue	4.5×10^{-5}
Limit of violet	4.0×10^{-5}
Ultra-violet	3.5×10^{-5} to 1×10^{-6}
X-rays	1×10^{-7} to 1×10^{-9}
Gamma (X) rays	2×10^{-10}
Cosmic rays	4×10^{-12}

(1) Electrical radiations. — Physicians have used shortwave radio transmitters for producing fever in the human subject and thus for combatting certain infectious diseases. Eggs have also been cooked, by holding them in the field of the transmitters, due to the production of internal heat. In fact, all organic compounds studied, especially cholesterin, rise in temperature when subjected to high frequency radio waves. Insects were killed, when exposed to waves 24 meters in length and with a frequency of 12,000,000 cycles per second, with merely a current of 1.75 amperes. The lethal effect was very probably due to the development of heat in the body of the animals beyond the limits of tolerance (Headlee and Burdette, 1929, and Headlee, 1931). The propagation of electrical energy with a vibratory frequency of 1,000,000 to 3,000,000 cycles per second and with a field strength of 4,000 volts per inch could destroy certain insects enclosed in the electrostatic field, i.e. between the two plate electrodes, without injury to the host plants. In practical use of radio waves it was suggested that « the margin of safety between the energy level which will kill insects and damage plants at 3,000,000 cycles per second is very wide but that the energy level which will kill insects and plants at 16,000,000 is very narrow ». In all cases the insects irradiated were hot to the touch although the glass containers containing the insects were cool. Probably the insects had been killed not by electrocution but by the heat generated within them. The resistance of grasshopper embryos (Evans, 1934) to radio waves varies inversely with the rate of development and of metabolism. This is true for harmful agents in general.

(2) Visible radiations. — The influence of alternating periods of

light and darkness on the production of winged offspring among aphids has been discussed earlier.

(3) Ultra-violet radiations. — « Vitamin D » has been shown to be produced from ergosterol irradiated by ultra-violet rays and is essential for bone deposition in the higher vertebrates. It is synthesised on exposure of the body to ultra-violet light or else eaten as such.

Contrary to the condition in vertebrates, not only have no beneficial effects been found by irradiating insects with ultraviolet rays but, on the other hand, definitely harmful effects. This does not mean that insects have no necessity for *vitamin D* since this may be obtained in their food, and certainly is in the case in *Drosophila* feeding on yeast. Eggs of *D. melanogaster* (Geigy, 1931) exposed to ultra-violet, five hours after laying, for 1.5 minutes all developed to the adult stage and the larvae showed no defects. The adults, however, were affected in the following manner: (1) When the dorsal and lateral regions of the egg were exposed some of the tergal plates of the abdomen failed to appear and the length of the abdomen was thus shortened; (2) When the ventral area of the egg was exposed, the thorax, wings, legs, and sternal region were defective. The fact that the larvae showed no apparent defects was considered to be the first proof that there are specific *adult* embryonic cells in the embryo of an endopterygote (« holometabolous ») insect. In light of what we now know of the imaginal buds of endopterygote insects, this seems to be one of the most important discoveries made by the irradiation of arthropods. Pupal and late larval stages of *Drosophila* (Geigy, 1926), when exposed to ultra-violet rays, showed, in a high percentage of cases, abnormalities of the abdomen, hairs, thorax, and pigmentation on the side exposed to the radiations. Such abnormalities did not, however, appear in the offspring. This is in line with present-day knowledge in which it is realised that agents affecting the somatic cells of an animal in a definite manner do not produce the same specific effects on the offspring.

One of the most ravaging cases known of the effects of ultra-violet rays on arthropods is that described by MacGregor (1931). Ultra-violet rays within the wave length range of 2,150 and 2,850 Å.u., especially at 2,500 Å.u., causes, after only a three-minute exposure, a partial paralysis in larvae of the mosquitoes, *Aedes aegypti* and *Culex pipens*, followed by progressive dissolution of many tissues, though principally affecting the fat-body.

In large doses, ultra-violet is definitely harmful to honey-bee worker adults (Bertholf, 1933) as determined by their longevity. Small doses produced no extension of longevity and no apparent increase in vigor. The larvae were easily destroyed by ultra-violet rays of wave lengths shorter than 2,970 Å.u.. The younger larvae, as would be expected, were more susceptible than the older ones. Here, too, the administration of small doses yielded no apparent

beneficial effects. It is quite evident that the ultra-violet irradiation of honey-bee larvae and adults is not commercially valuable.

(4) X-rays (Röntgen rays). — When the poles of an electric current at very high voltage are placed in a gas-free chamber, some of the particles travelling from the cathode pole to the anode pole are reflected from the anode and are radiations of very short wave lengths (Table III) known as X-rays, or, after discoverer, Röntgen rays. By placing a target between the anode and the cathode the particles can be reflected along a desired path. The target is often made of platinum since this has a high melting point and can thus withstand high temperatures. The entire gas-free chamber is called a cathode tube.

The intensity of X-rays is often expressed in terms of multiples of the human erythema dose, or that intensity which will just produce reddening of the human skin when applied for 5 minutes (= 85,000 volts or 85 kilovolts, 4 milliamperes, without filter, at a target distance of 23 cm.). The effect of an irradiation varies with its quantity, that is, is an intensity-time product, similar to the Bunsen-Roscoe rule for visible rays. By maintaining the intensity constant the quantity of irradiation can be increased by merely increasing the duration of application. In specifying the quantity and nature of the X-rays used it is necessary to state the value of the milliampere minutes (milliamperes, i.e. intensity of the electric current, × the time of exposure in minutes), of the voltage, and of the target distance, and whether or not a filter was used. Filters are used to absorb various wave lengths. Thus, an aluminum plate placed in the path of X-rays will absorb the X-rays with shorter wave lengths, i.e. the « harder » rays, but not those with longer wave lengths, i.e. the « softer » rays. By noting the quantity of X-radiation necessary to kill a given percentage of *Drosophila* eggs in a sample, Packard and Lauritsen (1931) could, however, find no differences in the biological effects of « hard » (wave length: 2,000 A.u.), « medium » (wave length : 5,000 A.u.), or « soft » (wave length : 7,000 A.u.) X-rays.

The biological effects of X-radiation become apparent some time after treatment.

The egg- and spermatozoa-forming cells are very susceptible to X-rays and this is an effective way of temporarily rendering an animal sterile. Five hours after radiation most of the spermatocytes in the testes of the lepidopteron, *Abraxas grossulariata* (Gatenby, Mukerji and Wigoder, 1929) were killed. The spermatogonia and spermatids were not so sensitive. Since no abnormal amphiastral figures were discovered it could not be shown that the prophase of cell division is exceptionally sensitive to X-rays. Exposure of the ovaries of the orthopteron, *Dixippus morosus* (Toumanof and Veretennikoff, 1930), to soft X-rays (aluminum-filtered, 75,000 volt X-rays) for 10 minutes at a distance of 23 cm. produced no effects. An exposure of 20 to 30 minutes varied from nothing to complete castration. His-

tological examinations indicated that the reproductive cells are most sensitive to X-rays.

The spermatozoa of *Drosophila* (Barth, 1929) containing the Y sex chromosome are more resistant to X-rays than are spermatozoa containing the X sex chromosome. This was shown, in part, by the fact that X-rayed males mated to non-irradiated females produced 6.7 times more males than that allowed for by the probable error (taking into consideration the 1:1 sex ratio as demonstrated by control flies). It may be stated here that a male somatic cell of *Drosophila* contains an XY pair of sex chromosomes, while the female has an XX pair.

The phasmid, *Dixippus morosus* (Toumanoff and Veretennikoff, 1930), reproduces entirely parthenogenetically in Europe, producing nothing but females. The Indian race, however produces males occasionally. No males were produced from irradiated females of the European race. This shows that, in this case unlike in *Drosophila*, the condition tending to produce male characteristics is not given ascendency, in the sex-determining balance, by irradiation.

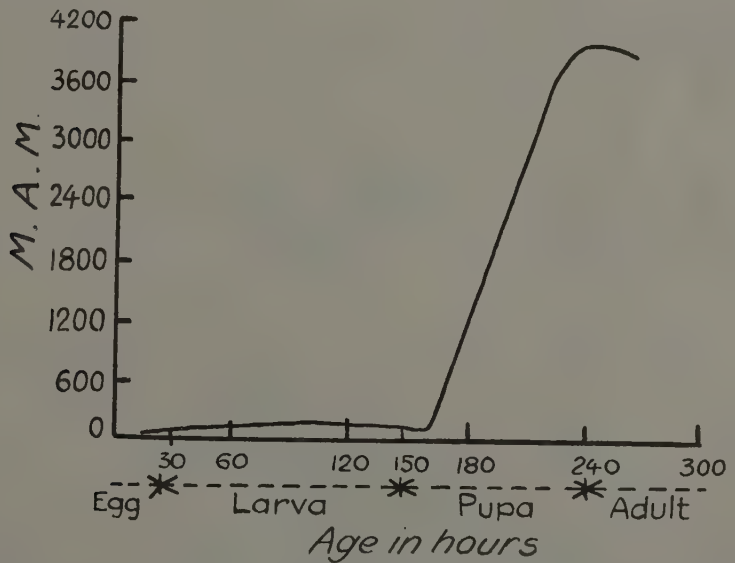

Fig. 18. — The X-ray dose in milliampere minutes, M.A.M., at 50 kilovolts, 50 milliamperes, and a distance of 25 cm. from the insect (*Drosophila melanogaster*) necessary to kill 50 per cent in 5 days after X-raying. — (After Mavor).

The eggs of X-radiated adults of the bee-moth, *Galleria mellonella* (Baldi, 1924), do not hatch, nor do eggs coming from individuals which

had copulated prior to treatment, nor do eggs from those females which had copulated with X-radiated males. The relatively high sensitivity of the germ cells to irradiation is brought into excellent relief in these experiments, for, the individuals harboring the destroyed germ cells behaved normally.

The resistance to X-rays of *Drosophila melanogaster* (Mavor, 1927) increases with development, though it shows a slight decline soon after pupation (fig. 18). During metamorphosis, resistance increases at a relatively great rate until, by the completion of metamorphosis, resistance is approximately 100 times that of the egg when laid. There is a slight decline in resistance during the adult period. Male pupae were more susceptible than female pupae. According to Henshaw (1934), *Drosophila* embryos are relatively susceptible during cleavage and blastulation but most susceptible during the onset of gastrulation. It has been known for some time that vertebrate embryos are particularly sensitive to experimental treatment at the gastrula stage. Runner (1916), too, had found that longer exposures to X-rays are required to kill eggs of the tobacco beetle which are about to hatch than are necessary to destroy eggs that are newly laid. The susceptibility of *Drosophila melanogaster* larvae (Woskressensky, 1928) varies inversely with age in the form of a hyperbolic curve, the rate of increase of resistance being greatest during the second, or last, day of larval life (fig. 19). It should be noted that, while Mavor had also observed an increase in resistance to

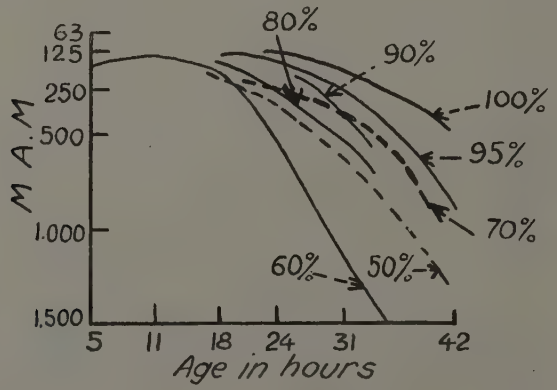

Fig. 19. — The X-ray dose, in milliampere minutes, delivered to larvae of *Drosophila melanogaster* 1 to 2 days of age. The percentage of deaths produced by a given dosage are indicated against the curves.—(After Woskressensky).

X-rays with advancing larval development (fig. 18) he did not find the marked hyperbolic relationship that Woskressensky did. The latter author noted that decrease in sensitivity was synchronous with the decrease in the velocity of growth. Koidsumi (1930) confirmed the above results by

finding that the resistance of the flies, *Dacus cucurbitae* and *D. dorsalis*, to X-rays increased as development proceeded from the embryo to the fully grown larva. In identity with Mavor's work he also found that, at the beginning of pupatiton, resistance decreases, to increase again with the emergence of the adult. Actively developing larvae of the wasp, *Sceliphron caementarium* (Bodine and Evans, 1934) are more sensitive to X-rays than blocked or « diapause » larvae.

In 1916 Cramer pointed out that the cells most susceptible to X-rays and radium are those richest in water and that this may be because water is a good absorbent of X-rays and radium emanations. Cramer deduced this relationship from the fact that vertebrate tumor cells and the vertebrate testes are especially rich in water and are most susceptible to X-rays and radium. This statement, however, cannot be considered to be generally applicable and therefore has no theoretical importance. Thus, there is, in fact, an *inverse* relationship between the relative water content of insects and their susceptibility to X-radiation, as exemplified by the results of Kellner, Sako and Sawano (1884) on silkmoth larvae, of Rudolfs (1926) on larvae of the moth, *Malacosoma americana*, and of Teissier (1931) on larvae of the beetle, *Tenebrio molitor*, and of the moth, *Galleria mellonella*, all of which show that there is a continuous increase in the relative water content of the larvae of many endopterygote insects with age until shortly before pupation and that this content is highest during older larval instars, i.e. when resistance to X-rays is increasing, attaining a level of 83 to 88 per cent of the total weight. This is even higher than Cramer's figures of 83 to 84.5 per cent for tumor tissues and 83.0 per cent for the testes of mammals. We should, furthermore, like to know why the period of gastrulation should be so susceptible. This certainly cannot be merely owing to relatitve water content.

Very enlightening results were obtained by Hufnagel and Joly (1933) by the irradiation of mature, non-feeding larvae of the blowfly, *Calliphora vomitoria*, approaching the time for metamorphosis. The dosage was such as to allow the larvae to transform into pupae with a normal exterior, both as to pigmentation and form, but with considerable internal modifications. There were, in the pupae, entirely no signs of imaginal muscles or imaginal myoblasts, or of the imaginal fat body. The larval fat body persisted, instead of disintegrating as it normally should do, and occupied the space which would have been occupied by the adult wing muscles. The purely larval muscles also remained. The nervous system was adult in gross appearance. Adults did not emerge from such pupae. The contrast in the susceptibility to X-rays of the larval and embryonic imaginal cells is here, spatially rather than temporary exemplied in a single individual.

By treating *Drosophila* larvae with X-rays. Hussey, Thompson,

and Calhoun (1927) noted an extension of the larval and prepupal periods beyond those for the controls. This was later confirmed by Tennant (1931) who also found a maximal prolongation of the prepupal stage beyond which a decline followed by increasing the quantity of irradiation (fig. 20 B). Koidsumi (1930) showed the following empirical equation to hold for the data of Hussey, Thompson and Calhoun :

$$D = D_0 e^{kx}$$

where D is the duration of the prepupal period of the animal which had been X-rayed, D_0 the duration of the untreated insect under otherwise identical conditions, e the base of Napierian logarithms, k a constant, and X the time of exposure to the X-rays of a given uniform intensity. The constant, k, is

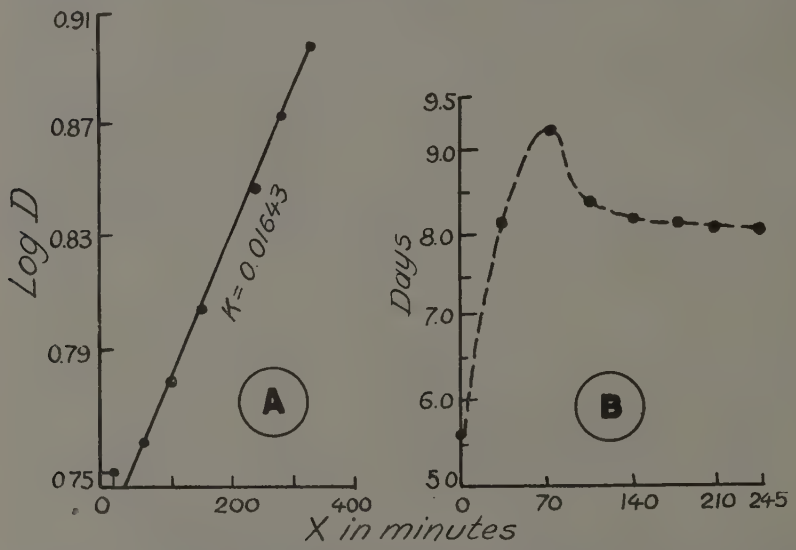

Fig. 20. — A. The relationship of the time of the duration of the prepupal period, D. of the fly, *Dacus cucurbitae* or *D. dorsalis*, (expressed in logarithms) to the time of exposure to X-rays (abscissa) of constant intesnity (target distance 54 cm. with aluminum or copper filter) (After Koidsumi). — B. The relationship of the duration of the prepupal period of the fly, *Drosophila*, to the time of exposure to X-rays of constant intensity. — (After Tennant).

obtained by plotting the values of log D against the time in minutes (fig. 20 A) and then k determined by finding the tangent the straight line makes with the abscissa (tan a = k). The greater the $< a$ the greater its tangent and hence the greater would be the constant of increase of the prepupal period per unit increase in time of exposure. Referring to his own data on the

destructive effects of X-rays on the flies, *Dacus cucurbitae* and *D. dorsalis*, Koidsumi (1930 a) showed the following formula to hold for any given stage :

$$N = N_0 e^{kx}$$

where N is the percentage of irradiated animals killed, N_0 the percentage of controls dead, and X the time of exposure to X-rays of a given uniform intensity. This formula is identical with the one above expressing the extension of the prepupal period of *Drosophila*. Both formulae are similar to $Q = Q_0 e^{-kw}$ which expresses the radiochemical inactivation of several enzymes. Koidsumi therefore suggested that the effects of X-rays on organisms are due to their effects on enzymes. This may be true in part but does not explain why cells in the process of mitosis are most susceptible to X-rays.

Contrary results were obtained by Gatenby, Mukerji and Wigoder on the lepidopterons, *Callimorpha jacobae* and *Abraxas grossulariata*, when it was discovered that 4.5 times the human erythema dose actually hastened the pupation 10 to 11 days beyond that of the controls.

Now, as to the effect of X-rays on fully differentiated adult arthropods. Even in small doses, irradiation decreases the life span of adults of the bee moth, *Galleria mellonella* (Baldi, 1924). They lost their power to fly, walk, and equilibrate as well as the motor activity of the antennae, head, and other parts. The action was even more profound on the adults than on the larvae since the larval mortality rate was relatively small. In marked contrast to these results are those of Crawford (1928) on termite adults, *Kalotermes immigrans*. These, subjected to X-rays (max. 30 K.V.) for 5 to 30 minutes, appeared entirely unaffected even after several days. Even more remarkable are the results of Toumanoff and Veretennikoff on exposure of the phasmid, *Dixippus morosus*, to X-rays (75,000 volts for 10 minutes to 1 hour ; target distance 23 cm. ; aluminum filter). The longevity of the total or partial castrates was greater than in insects which conserved the capacity of laying in spite of irradiation and even greater than that of untreated insects. Their work indicates that the elaboration of eggs normally decreases the longevity of an individual.

X-radiation of the cladoceran, *Simocephalus vetulus* (Obreshkove and King, 1932), produced in every female individual an invagination of the upper portion of the brood chamber so that the back of the animal becomes concave instead of convex as it normally is. This change develops gradually, becoming more pronounced with each succeeding molt. No other abnormal morphological changes were observed.

(5) Gamma rays, and alpha and beta particles. — Certain elements with relatively enormous molecular weights, such as radium, polonium, and uranium, are radioactive, that is, they emit streams of negatively charged particles (electrons, or the « beta particles »), positively charged

particles (helium atoms which have lost one or two electrons in the formation of beta particles, and known as the « alpha particles »), and gamma rays (radiations with extremely short wave length, see Table III). Uranium, with the highest atomic weight, is transformed to ionium, ionium to radium, radium to polonium, and polonium to lead. With each disintegration the atomic weight declines.

A sheet of aluminum or mica 6 mm. in thickness, a sheet of ordinary writing paper, 32 microns of water, or 4 cm. of air is sufficient to completely absorb all the alpha particles. Penetration into protoplasm may be considered to be equal to that into water. Beta particles are about 100 times as penetrating as alpha particles, while gamma rays will penetrate through 15 cm. of lead. Henshaw and Henshaw (1933) subjected eggs of *Drosophila*, at various stages during embryonic development, to the three forms of radiation emitted by polonium. The eggs were exposed at 15, 30, and 45 minutes. They were more susceptible (determined by percentage hatch) during cleavage and blastulation and more resistant during organogenesis. Maximum sensitivity was reached at, or just after, the beginning of gastrulation. It is noteworthy that during gastrulation the vertebrate embryo is least resistant to disturbing environmental changes. What is it during this period that makes an embryo so sensitive ? The eggs were most resistant to X-rays when most sensitive to the alpha particles. That the results were entirely due to the alpha particles was shown by the fact that entirely no effects were produced when a sheet of writing paper was placed in between the polonium and the eggs. Furthermore, pure polonium is known to emit α particles only. Since the transverse radius of a *Drosophila* egg is about 50 microns it is improbable that the alpha particles never reach itts center but are probably absorbed near the surface of the embryo since they pass through 2 cm. of air, and the membranous egg shell.

Henshaw and Henshaw explained the destructive properties of the alpha particles by stating that « since the large supply of kinetic energy possessed by the alpha particles is expended in so short a distance much greater destruction is caused per unit length of their trajectory ». Hufnagel and de Nabias (1928), also observed no abnormalities in the adults and no retardation or acceleration of development when the pupae of the fly, *Calliphora*, and of the lepidopteron, *Hyponomeuta*, had been exposed to the gamma rays emitted by radium, even after prolonged irradiation. Terao and Wakamori (1926) irradiated silkmoth larvae at various intervals during growth by approximating them to uranium oxid. The alpha particles were probably not utilised at all. Cocoons produced from those irradiated in the first and fifth larval instars were heavier than those irradiated in other instars and than the controls. Though it was stated that lighter cocoons were obtained by those irradiated during the whole of the larval period, the actual

figures presented did not indicate this. The English of the paper was, at certain points, incomprehensible.

Summary

1. When still within the egg shell or when within the reproductive system of the female parent, an animal may be said to be in the embryonic, or pre-natal, stage of its life. In forms which possess free-living embryos, the larval period may be said to commence and the embryonic to cease when the organism becomes mobile within its environment.
2. The eggs of most arthropods are centrolecithal and their embryos meroblastic.
3. There is a time sequence in the three-dimensional development of an embryo, and this is, in general, antero-posterior
4. In many cases a differentiation center has been observed and, in one case, this has been demonstrated to be due to heterochronic cell division.
5. There is no justification in choosing the time of fertilisation as the time of development.
6. In arthropods in general the capacity for regulation, or reconstitution, ceases early during development — in many cases soon after fertilisation and before the zygote nucleus begins to divide. Development is then mosaic rather than regulatory.
7. Many insects hatch from the egg by exerting a centrifugal force on the integument of the head and thus by increasing the pressure on the anterior end of the egg shell. The actions producing such a force are antiperistaltic movements of the gut, contraction of the trunk segments, and the swallowing of air.
8. The actual values for the rate of respiration of arthropod eggs, now at hand, do not represent the rate per given weight of actively metabolising, i.e. living, material.
9. Whether or not winged offspring will be produced from aphids depends upon the environmental conditions about the female parent during the embryonic life of its offspring, for, these animals are generally oviviparous. Thus, an alternation of about 8 hours light and 16 hours darkness is most effective in producing wings. Continuous light produces almost exclusively wingless offspring. The enhancement of wing production by deficient food supply or by metallic salts seems to be of adaptive significance in allowing the species to disperse to more favorable environments.
10. In its energy requirements, a living growing system requires a liberation of energy for maintenance and for chemical syntheses.

11. The utilisation of fat or carbohydrate as sources of energy during embryonic life, in *lieu* of protein, is suitable in an animal which is enclosed by a shell and thus, if terrestrial, has no means of getting rid of its nitrogenous wastes to the exterior.
12. Embryos of terrestrial eggs undergo a uricotelic type of metabolism.
13. It seems probable that the reason so many groups of animals flourishing in sea water have not established themselves in fresh-water is because of an inadequate installation of inorganic salts in their eggs during oogenesis.
14. The capacity of animals which undergo a uricotelic metabolism to synthesise nuclein material, and therefore purine bases, is associated with the fact that they transform all or most of their proteins to uric acid.
15. In insects and cladoceran Crustacea both the determination and differentiation of sex is confined solely to the nucleus. In vertebrates and decapod Crustacea hormones are necessary for the differentiation of sex.
16. A gynandromorph is a sex mosaic, which results from an unusual disturbance of nuclear division during development.
17. A hermaphrodite is not a sex mosaic since all its somatic cells are identical in nuclear constitution. There are only a few authentic cases of hermaphroditism among arthropods, none of which occur among insects. The latter frequently exhibit gynandromorphism.
18. Natural parthenogenesis is not uncommon among arthropods.
19. Sterility, in one case, has been shown to be due to a senile loss of function in the ejaculatory apparatus and not to a failure of spermatogenesis.
20. The number of eggs laid by a given species varies with its nutritive state and with its size. Fecundity is also influenced by various temperature-humidity combinations.
21. Oogonia and spermatogonia are very susceptible to X-rays and X-radiation is an effective way of temporarily rendering an animal sterile.
22. Resistance to irradiation increases with development, there being a slight decline in resistance during the adult period. There is thus, in such cases, an inverse relationship between the relative water content of insects and their susceptibility to X-radiation.
23. The effects of X-rays on organisms may be primarily due to their effects on enzymes.

Séance du 16 Juin 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Sur une larve Méloïde d'espèce inconnue trouvée sur *Anthia cavernosa* Gerst.

Etude bio-anatomique

(avec 1 Figure)

par le Dr A. Cros

Gerstaecker a décrit et figuré dans son travail intitulé : « Baron von der Decken's Reisen in Ost-Afrika, Die Gliederthiere Fauna des Sansibar Gebietes » (*Archiv f. Naturgesch.*, 1873, III B., 2 Abth., p. 212, Taf. XI, fig. 1), une larve méloïde d'un aspect très particulier, dont il avait trouvé un certain nombre d'exemplaires fixés sur le corps d'un Coléoptère de la famille des Carabiques habitant l'Afrique orientale (Zanzibar), l'*Anthia cavernosa* Gerst., et qu'il n'a pu rapporter à aucun type larvaire de Méloïde connu à cette époque.

Une larve correspondant complètement à la description et aux dessins de cet insecte, provenant de la région du lac Nyassa, trouvée également fixée sur *Anthia cavernosa*, et appartenant au British Museum de Londres, m'a été aimablement communiquée aux fins de détermination par M. K. G. Blair, Assistant au dit Museum. J'ai pareillement reçu du Museum National d'Histoire naturelle de Paris, pour étude, une larve identique découverte, elle aussi, sur une *Anthia cavernosa* prise à Taveta (Afrique orientale anglaise) par M. Charles Alluaud.

J'adresse à MM. K. G. Blair et Ch. Alluaud mes bien sincères remerciements pour la communication de ce précieux et rare matériel.

Comme l'ouvrage de Gerstaecker est plutôt rare dans les bibliothèques françaises, et qu'il est par suite assez difficile de le consulter, et que d'autre part il n'est pas à ma connaissance qu'il existe une traduction française de la description de cette larve, je vais la décrire à mon tour, en faisant suivre cette description de quelques remarques et réflexions.

Description de cette larve.

Aspect général. — Larve hexapode, fortement chitinisée, allongée, aplatie, composée de 13 segments, savoir : la tête, 3 segments thoraciques et 9 segments abdominaux, terminée par deux soies caudales divergentes. Coloration d'un brun ferrugineux uniforme. Pilosité accusée.

Longueur : 2 mm. 5; sans les soies caudales, 3 mm. en tenant compte des soies caudales; largeur maximum au milieu de l'abdomen : 0 mm. 55.

Tête allongée, d'un tiers plus longue que large, arrondie en avant, ou plutôt ogivale, rectiligne en arrière, ayant sa plus grande largeur à la jonction du tiers antérieur avec le tiers moyen, en avant des yeux, légèrement rétrécie d'avant en arrière à partir de ce point, à angles postérieurs arrondis. Présente à sa face supérieure, en arrière, sur son quart postérieur une ligne suturale

claire médiane antéro-postérieure (ligne de déhiscence), qui se bifurque en avant, et dont les branches de bifurcation formant entre elles un angle assez étendu, se recourbent insensiblement en se redressant pour se diriger à peu près parallèlement en avant jusque vers le milieu de la tête, où elles s'infléchissent en dehors pour aller aboutir au-devant de la région oculaire vers la base des antennes.

A la face inférieure, les deux hémicranes se rejoignent presque vers la ligne médiane en arrière dans son tiers postérieur, mais présentent au niveau du tiers moyen une large échancrure dans laquelle sont logés les maxillaires latéralement, et au milieu, la lèvre inférieure avec les palpes labiaux.

La partie céphalo-frontale comprise entre les branches de bifurcation de la ligne de déhiscence se prolonge en avant, à partir de la base des antennes et des mandibules, en un long clypeus occupant toute la largeur de la tête. A sa face inférieure ce clypeus, à quelque distance de son bord antérieur, présente une ligne circulaire parallèle au bord libre sur toute son étendue, de la naissance des mandibules d'un côté à l'autre, comme s'il était en quelque sorte rebordé. Ce rebord devient un peu plus large en se rapprochant de l'origine des mandibules. Un peu en arrière de ce rebord se trouve de chaque côté, à quelque distance de la ligne médiane, un fort poil ; vers le milieu des bords latéraux du rebord, près de son bord interne, existe de chaque côté un autre poil, et plus en arrière, au niveau où le bourrelet commence à s'élargir, on voit un autre poil un peu moins développé, situé à la partie centrale du bourrelet. Outre ces poils assez accusés, il en existe d'autres plus petits : un à côté et en dedans de chacun des deux poils para-médians antérieurs, et deux autres de chaque côté sur la surface du clypeus à l'intérieur du bourrelet, l'un en avant, à moitié distance entre le poil antérieur paramedian et celui situé sur le bourrelet, l'autre beaucoup plus en arrière.

Chétotaxie. — A la face supérieure de la tête, en arrière, région occipitale, chaque hémicrane porte près de son bord postérieur, à moitié distance entre le bord latéral et la ligne de déhiscence une longue et forte soie. De chaque côté de la partie rectiligne de la ligne de déhiscence, en arrière, existent deux petits poils, l'un en avant, l'autre en arrière ; un troisième se voit un peu après la bifurcation de cette ligne, à proximité de chaque branche. En outre, sur les bords latéraux existent trois grands poils, un en avant de chacun des yeux, un autre un peu en arrière de ces organes, le troisième à moitié distance environ entre l'œil et l'angle postérieur de la tête. Il ne paraît pas y avoir de poils franchement développés sur le clypéofrons.

Antennes situées vers le milieu des bords latéraux de la tête, en avant des yeux, en arrière de l'origine des mandibules, insérées au-dessous du rebord de la tête ; composées de trois articles : le premier court, assez large, plus large que long, en rondelle cylindrique ; le deuxième beaucoup plus long, cylindrique, d'un diamètre moindre, deux fois et demie plus long, portant sur son bord supérieur et antérieur un poil divergent assez développé ; le troisième en batonnet cylindrique, d'un diamètre un peu plus petit que le deuxième, à peu près aussi long que les deux premiers réunis, porte à son extrémité une forte soie aussi longue que l'antenne entière, et deux autres poils insérés près de son extrémité apicale, beaucoup moins développés, placés sur son pourtour en couronne divergente.

Gerstaecker a décrit en outre et figuré sur l'extrémité apicale du deuxième segment un organe sensoriel placé en arrière du troisième segment, formant une petite saillie globuleuse, plus courte que le troisième article. Je n'ai pu l'apercevoir que d'une manière imprécise sur les deux sujets que j'ai examinés, en raison des défectuosités de leur préparation consécutives à leur dessication.

Yeux simples, situés un de chaque côté de la tête, légèrement en arrière de sa moitié antérieure, et un peu au-dessous de son bord latéral, avec une cornée légèrement convexe en forme de verre de montre, saillante, arrondie, décolorée et devenue blanche par vieillissement, entourée d'une zone circulaire de faible étendue de pigment d'un noir intense.

Lèvre supérieure indistincte. — Peut-être est-elle fusionnée avec le clypeus, et représentée par le bourrelet qu'il présente à sa face inférieure.

Mandibules plus ou moins coniques, à pointe mousse, un peu courbes vers leur tiers apical, avec un fort renflement apophysaire à leur base, dépourvues de toute denticulation, se croisant au repos sur toute leur longueur à partir de l'apophyse basilaire.

Maxillaires à stipe allongé, assez difficile à bien voir, paraissant dépourvu de galéa et de lacina nettement différenciés ; portant, d'après Gerstaecker, une soie isolée, pendant que le bord externe paraît en avoir deux semblables. Je n'ai pu arriver à les discerner. Il ne semble pas y avoir de lobe externe bien accusé.

Palpes maxillaires assez difficilement visibles, composés de trois articles. Le premier court, en rondelle cylindrique, deux fois aussi large que long ; le deuxième, de même forme, mais d'un diamètre plus petit ; le troisième allongé, un peu plus long, plus large à sa base qu'à son apex qui est terminé par une surface plane. D'après Gerstaecker cette surface serait velue : sans doute porte-t-elle des papilles de petite taille que je n'ai pu distinguer.

La *lèvre inférieure* et les *palpes labiaux* ont échappé à Gerstaecker. J'ai pu voir les palpes qui sont composés de deux articles cylindriques, le premier en rondelle, le deuxième deux fois plus long, assez distants l'un de l'autre.

Thorax. — Prothorax trapézoïdal, à peine moins long que la tête, ayant en avant même largeur qu'elle à sa partie postérieure ; d'un tiers plus large en arrière qu'en avant, à peu près aussi long que le mésothorax et le métathorax réunis ; avec un tergite chitineux qui présente sur la partie médiane antéro-postérieure une ligne suturale claire (ligne de déhiscence) faisant suite à la ligne de déhiscence de la partie postérieure de la tête. Le tergite chitineux recouvre les parties latérales qu'il déborde un peu en dessous. La face ventrale paraît simplement membraneuse, et donne insertion à la première paire de pattes. Ce segment présente à ses angles postérieurs deux fortes soies, et une autre semblable sur son bord postérieur à moitié distance entre le bord latéral et la ligne de déhiscence.

Mésothorax de moitié moins long que le prothorax, à peu près de la même largeur que lui en arrière ; à bords convexes ; présente comme lui sur le tergite une ligne suturale claire médiane antéro-postérieure. En dessous il donne insertion à la deuxième paire de pattes. Il est muni sur les parties latérales, de chaque côté, d'un gros stigmate rond. Il porte sur le milieu des bords latéraux, de chaque côté, une forte soie, deux autres à ses angles postérieurs, et une autre sur son bord postérieur.

Métathorax de même forme, mêmes dimensions, mêmes poils que le mésothorax, mais il n'existe pas chez lui de ligne de déhiscence ni de stigmates. En dessous il donne attache à la troisième paire de pattes.

Abdomen composé de 9 segments, tous de même longueur, mais dont la largeur va en augmentant du premier au cinquième, les quatre derniers décroissant progressivement, et le dernier n'ayant que la moitié de la largeur du cinquième. Le neuvième et dernier est arrondi en arrière, et porte deux longues soies caudales divergentes. Tous ls segments abdominaux portent à leur face dorsale sur le bord postérieur du tergite une rangée de poils robustes dont la longueur égale si elle ne la dépasse pas celle du segment suivant.

Pattes composées d'une hanche, d'un trochanter, d'un fémur (ou cuisse), d'un tibia et d'une griffe terminale (ou tarsungulus).

Hanche robuste, plus longue que large, comprimée latéralement, coupée obliquement à son point d'attache ainsi qu'à son extrémité distale, plus large à son origine qu'à son extrémité.

Trochanter un peu courbe, plus étroit à son origine qu'à sa soudure au fémur, celle-ci oblique.

Fémur de moitié moins gros que la hanche, en cylindre comprimé, d'égal diamètre partout, nullement renflé, coupé obliquement à son extrémité distale, portant en dessus à cette extrémité deux poils, et un autre en dessous juste au-dessus de son articulation avec le tibia ; il porte également une soie implantée perpendiculairement sur son bord inférieur un peu au-dessus de sa partie médiane.

Tibia allongé, à bord supérieur un peu courbe, à bord inférieur rectiligne, celui-ci muni de nombreux poils spiniformes à direction oblique en bas.

Griffe (ou *tarsungulus*) du type en fourche à trois branches. Ongle central falciforme, à pointe très aiguë articulé avec le tibia, ayant un renflement accusé à sa base sur lequel s'insèrent un de chaque côté, à la même hauteur, deux poils onguiculaires de même forme, mais plus petits et d'inégale grandeur, divergents.

Les trois pattes sont de même forme, mais augmentent de longueur de la première à la troisième.

Stigmates au nombre de neuf paires, une sur le mésothorax, et une sur chacun des huit premiers segments de l'abdomen, tous de même grandeur, arrondis.

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Caractères distinctifs. — Cette larve ne saurait être confondue avec aucune autre larve connue de la famille des *Meloidae*, en raison de la forme de sa tête, de sa coloration rouge-brun, de son abondante pilosité.

Elle se sépare des larves des *Meloe tuccius* Rossi et *M. murinus* Brandt, qui sont du même type, par sa taille de beaucoup supérieure et par sa coloration rouge-brun, alors que celles-ci sont de couleur noirâtre. Elle se sépare également de celle du *Meloe brevicollis* Panz., qui est du même type, mais qui est aussi noirâtre, par sa coloration rouge-brun et son clypeus beaucoup plus développé. Par ces mêmes caractères elle se sépare de la larve jaune d'espèce indéterminée que j'ai attribuée hypothétiquement et sous toutes réserves au *Meloe rugosus* Marsh.. Aucune confusion ne saurait non plus se produire avec la larve du *Meloe cicatricosus* Leach, qui appartient aussi à ce même type larvaire, et a une taille voisine de la sienne, mais dont la couleur est jaune.

Elle se distingue des larves du type *Meloe proscarabaeus* (*M. proscarabaeus* L., *M. violaceus* Marsh., *M. autumnalis* Ol.) ainsi que de celles du *M. foveolatus* Guérin et des *M. cavensis* Petagna et *M. variegatus* Donov., entre autres caractères, par la forme de sa tête, par ses cuisses non renflées et ses griffes en fourche à trois branches, tandis que les espèces ci-dessus énumérées ont leurs cuisses fortement renflées et leurs griffes en trident de Neptune.

Quant aux *M. majalis* L. et *M. chrysocomus* Mill. dont les formes sont analogues à celles des larves des *Lyttini*, et qui d'ailleurs sont fouisseuses et ne se rencontrent jamais sur les Hyménoptères, la confusion n'est pas à redouter si l'on tient compte de leurs principaux caractères, notamment de la forme de la tête et de leur coloration variée. Il en est de même pour le *Meloe affinis* var. *setosus* Escher. que le développement spécial des stigmates du 8e segment de l'abdomen suffit amplement à caractériser.

Les larves des *Lyttini*, *Epicautini*, *Cerocomini*, *Mylabrini*, ont une tête presque carrée, des mandibules faiblement cachées au repos derrière le labre qu'elles dépassent largement quand elles sont ouvertes, et leurs pièces buccales ont une conformation bien différente, de même que leurs antennes. De plus elles sont fouisseuses et ne se rencontrent jamais sur les Hyménoptères et autres insectes floricoles velus.

Quant aux larves de la sous-famille des *Nemognathinae*, leur forme naviculaire, la présence de deux ocelles de chaque côté de la tête et l'existence de deux cônes érectiles respiratoires dans l'espace qui sépare le 8e segment de l'abdomen du 9e à la face dorsale, sont suffisamment caractéristiques pour éviter toute confusion, la larve qui nous occupe ne présentant aucun de ces caractères.

De même les larves des *Horiini* fort semblables d'aspect à celles des *Nemognathinae*, et dont diverses espèces se rencontrent en Afrique centrale, mais sont dépourvues des cônes érectiles qui caractérisent ces dernières et

n'ont que des yeux simples, ne peuvent être confondues avec elles en raison de leur forme générale.

Habitat. — Les divers specimens de la larve décrite par Gerstaecker ont tous été trouvés sur des *Anthia cavernosa* capturées par le Baron von der Decken soit à Mombasa sur le littoral de l'Afrique orientale, soit dans l'intérieur des terres, au lac Jipé, qui se trouve au pied du mont Kilimandjaro, soit par M. Charles Alluaud à Taveta, localité située entre les monts Kenya et Kilimandjaro. Le sujet qui m'a été communiqué par le British Museum provient de la région du lac Nyassa beaucoup plus au sud. Leur présence est signalée par conséquent dans une vaste zone de l'Afrique orientale comprise d'une part entre l'équateur et le 15e degré de latitude méridionale, et s'étendant d'autre part dans l'intérieur des terres depuis les rives de l'Océan indien jusqu'au 30e degré de longitude est de Paris.

Il est du reste fort possible, sinon probable, que son domaine déborde plus ou moins largement ces limites, car l'*Anthia cavernosa* a une aire de dispersion très étendue qui va de la Somalie italienne et de l'Ethiopie au nord de l'équateur jusqu'au lac Nyassa au sud.

Il semble résulter également de ces données que ces larves ne se rencontrent pas au-dessus d'une certaine altitude : Mombasa est au bord de l'Océan, Taveta est à 750 mètres au-dessus du niveau de la mer, le lac Jipé à 730, et le « Pori de Seringheti » où M. Ch. Alluaud a rencontré en abondance l'*Anthia cavernosa* est situé à une altitude moyenne de 750 à 850 mètres, bien que certaines localités de cette région dépassent parfois 1000 mètres. Quant au lac Nyassa, il est situé à une altitude de 478 mètres seulement.

Epoque des captures. — Les *Anthia cavernosa* porteuses de larves capturées par le Baron von der Decken à Mombasa et au lac Jipé ont été prises en décembre 1862. L'*Anthia* sur laquelle M. Ch. Alluaud a découvert une de ces larves fixée au premier article de l'une des antennes avait été capturée à Taveta le 1er avril 1904. En ce qui concerne la larve provenant de la région du lac Nyassa communiquée par le British Museum, sa fiche porte le millésime 1905, mais la date précise de la capture n'est pas indiquée. Cette larve se rencontre donc pendant une période assez longue, environ 4 à 5 mois, de décembre à avril.

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Remarques. — Gerstaecker en fait de larves méloïdes ne connaissait que celles du *Sitaris muralis* Foerst., des *Meloe violaceus* Marsh. et *M. variegatus* Donov., et d'une manière qu'il déclare insuffisante celles de *Lytta* et de *Mylabris ;* aussi fut-il dans l'impossibilité d'attribuer à un genre quelconque de cette famille la larve trouvée sur *Anthia cavernosa*. Ecartant le genre *Sitaris*, dont elle s'éloignait d'une manière trop manifeste, et le genre *Meloe* (dont il ne mentionne d'ailleurs aucune espèce parmi les captures du Baron von der

Decken), à cause de la forme de ses cuisses non renflées et de ses griffes non en trident de Neptune, de sa tête qui ne ressemblait à la tête d'aucune des larves de *Meloe* connues à cette époque, il était amené à conclure qu'elle se rapprochait davantage des larves de *Lytta*, dont il n'avait pas les moyens de la séparer, faute de pouvoir examiner des larves appartenant à ce genre. Il reconnait cependant que la forme de la tête des larves de *Lytta* est différente. Mais il admettrait assez volontiers que cette larve pourrait appartenir à un genre de vésicants particulier à l'Afrique. Examinant alors les divers genres africains qui restent après l'exclusion des genres *Sitaris*, *Meloe* et *Lytta*, il écarte d'abord le genre *Eletica*, dont l'unique espèce alors connue habite la Guinée, contrée fort éloignée du point où la larve en question a été trouvée. Il croit pouvoir mettre également hors de cause les genres *Apalus*, *Zonitis* et *Nemognatha* du Cap. Restent alors seulement en ligne les genres *Horia* et *Mylabris*. *Horia cephalotes* existe, dit-il, dans l'île de Zanzibar sinon sur la terre ferme ; mais les larves d'*Horia* passent pour être parasites des Xylocopes. Par contre de nombreuses espèces de Mylabres ont été capturées en même temps et dans les mêmes parages que les *Anthia* porteuses de la larve en question. Gerstaecker en déduit que c'est à ce dernier genre que cette larve a le plus de chances d'appartenir.

Nous connaissons aujourd'hui de nombreuses larves de *Meloidae* qui étaient alors inconnues, notamment des larves de *Lytta*, *Epicauta*, *Mylabris*, et nous savons qu'elles ont des caractères bien différents de celle qui nous occupe, qu'elles ne s'attachent pas aux Hyménoptères, mais fouillent le sol, et vont par leurs propres moyens à la recherche des vivres. La supposition de Gerstaecker tendant à attribuer cette larve à un Mylabre n'est donc pas fondée. Nous connaissons également les larves de plusieurs espèces d'*Horiini* effectivement parasites des Xylocopes, qui appartiennent à un type différent, assez voisin de celui des larves des *Nemognathinae*. Nous savons de même que les larves de la sous-famille des *Nemognathinae* (*Sitaris*, *Apalus*, *Nemognatha*, *Zonitis*, etc.) appartiennent à un type larvaire tout à fait différent de la larve trouvée sur *Anthia cavernosa*.

Par contre, les larves des genres *Eletica*, *Cyaneolytta*, *Prionotolytta*, *Psalydolytta*, *Iselma*, genres exclusivement africains, qui se rencontrent fréquemment dans les régions habitées par *Anthia cavernosa*, sont encore complètement inconnues. Nous ne pouvons donc rejeter catégoriquement à priori l'idée émise par Gerstaecker que cette larve pourrait être celle d'un genre spécial à l'Afrique centrale.

Mais nous savons aussi que les larves primaires des Méloés, contrairement à ce qu'on croyait à l'époque où fut découverte la larve en question, n'appartiennent pas toutes à un seul et même type représenté par la larve du *Meloe violaceus* Marsh. La larve du *Meloe cicatricosus* Leach, dont Jules Lichtenstein nous a fait connaître les véritables caractères méconnus par

suite d'une regrettable confusion, celle du *Meloe brevicollis* Panz. obtenue par le Dr Verhoeff, décrite et figurée par G. Hachfeld, celles des *M. tuccius* Rossi et *M. murinus* Brandt et autres décrites par moi-même, ont des caractères à peu près semblables à ceux de la larve trouvée sur *Anthia cavernosa*. Elles ont les unes et les autres une tête à clypeus prolongé en avant bien au-delà des pièces buccales, leurs cuisses sont fusiformes et ne présentent pas le renflement considérable qu'elles offrent chez les larves des *Meloe proscarabaeus*, *violaceus* et autres, leurs griffes n'ont pas la forme d'un trident de Neptune, et leurs principaux caractères se retrouvent chez la larve qui nous occupe. En outre, ces larves s'attachent aux Hyménoptères mellifères, et se font véhiculer par eux dans leurs cellules où elles se développent en parasites. Il semble donc que la larve de Gerstaecker a les plus grandes chances d'appartenir à un Méloé africain. Reste à savoir lequel.

Les espèces de Méloés vivant au centre de l'Afrique ne sont pas bien nombreuses : c'est ce que fait observer Fairmaire (Coléoptères des pays Somalis et du Zanguebar), qui après la description du *Meloe atrocyaneus* découvert à Tabora par G. Revoil, écrit ceci : « Les Méloés sont fort rares dans l'Afrique intertropicale. Je ne connais, outre les deux espèces de Madagascar et les *Meloe aegyptius* et *angulatus* qui se trouvent en Egypte et remontent probablement jusqu'au delà des tropiques, que le *M. specularis* Gredl. (*Zool. Bot. ver. Wien*, 1877, p. 518) découvert à Gondokoro ».

C'est du reste sans doute par erereur que Fairmaire indique le *Meloe angulatus* Leach comme existant en Egypte, car tous les auteurs sont unanimes à le citer du Cap de Bonne-Espérance, et aucun, du moins à ma connaissance, ne mentionne sa présence en Egypte.

Peringuey (Descriptive Catalogue of the Coleoptera of South Africa, 1909) signale l'existence de cinq espèces dans le sud de l'Afrique. Ce sont les *Meloe angulatus* Leach (Cape Colony, Namaqualand), *M. meridianus* Pering. (Ovampoland, Southern Rhodesia, Transvaal), *M. caffer* Pering. (Natal, Transvaal), *M. hottentotus* Pering. (Cape Colony, Natal, Transvaal) et le *M. rhodesianus* Pering. (Habitat non indiqué, sans doute la Rhodésie.

Toutefois on a décrit depuis lors un certain nombre d'autres espèces du centre ou du sud de l'Afrique, savoir : *Meloe herero* Schmidt (Damaraland), *M. Lefebvrei* Guér. (Abyssinie), *M. monticola* Kolbe (Afrique orientale), *M. semicariosus* Fairm. (Afrique orientale), *M. ukinganus* Schmidt (Territoires au nord du lac Nyassa), *M. Seineri* Schmidt (Bechuanaland oriental). A cette liste il y a sans doute lieu d'ajouter le *M. Chevrolati* Coquerel et le *M. compressipes* C. O. Waterh., l'un et l'autre décrits de Madagascar, le dernier étant mis en synonymie du *M. Chevrolati* par Borchmann (Coleopterorum Catalogus), qui d'après Fairmaire peuvent bien se rencontrer sur le continent africain.

A laquelle de ces espèces pourrait bien appartenir notre larve, si comme je le crois, c'est réellement une larve de Méloé ? Il est absolument impossible

de le dire. Cependant on pourrait, semble-t-il, écarter plusieurs des espèces figurant dans la liste ci-dessus : tout d'abord le *M. specularis* Gredl., qui d'après Borchmann (Coleopterorum Catalogus de Junk et Schenkling, pars 69, *Meloidae-Cephaloidae*) ne serait qu'une variété du *M. cavensis* Petagna, dont la larve que nous avons fait connaître D. Vito Zanon et moi présente des caractères bien différents ; ensuite le *M. aegyptius* Brandt qui est rangé dans le sous-genre *Proscarabaeus* en raison de la forme de ses antennes dont les articles 5, 6 et 7 sont dilatés et tordus chez les mâles. Il en est de même du *M. monticola* Kolbe, et du *M. hottentotus* Pering. qui présentent une dilatation de ces mêmes articles des antennes, et doivent par suite être classés dans le même sous-genre *Proscarabaeus*. Or les larves du *M. proscarabaeus* et autres du même groupe (*M. violaceus* Marsh., *M. autumnalis* Ol.) bien connues, appartiennent à un type tout à fait différent.

Il y a lieu également de tenir compte que les *Anthia cavernosa* portant des larves ont été capturées en partie à Mombasa sur le littoral, au bord de l'Océan indien, en partie dans l'intérieur du continent africain (lac Jifé, altitude 730 mètres ; Taveta, 750 m. ; lac Nyassa, 478 m.). Or trois des Méloés cités ci-dessus ont été capturés par MM. Ch. Alluaud et R. Jeannel à des altitudes beaucoup plus élevées : le *M. monticola* Kolbe dans la zone des forêts du Kilimandjaro (Afrique orientale allemande), le *M. semicariosus* Fairm. (Synonyme du *M. atrocyaneus* Borchmann, d'après M. Pic), à la lisière inférieure de la forêt de Kinangop (alt. 2700 m., Afrique orientale anglaise) et à Kiléma (alt. 1400 m.) dans la zone des cultures du Kilimandjaro ; le *M. Lefebvrei* Guérin dans les prairies inférieures du mont Kenya (alt. 2000 m., Afrique orientale anglaise). Mais aucun n'a été pris par eux exactement dans les mêmes parages que les *Anthia cavernosa*. Il est à noter que Gerstaecker ne mentionne aucune espèce de Méloé parmi les captures du Baron von der Decken.

D'ailleurs, tandis que les *Cyaneolytta*, les *Epicauta*, les *Mylabris* habitent de préférence des régions d'altitude moyenne ou relativement peu élevée, ne dépassant guère 1200 à 1400 mètres, où règne une chaleur intense, les Méloés au contraire, d'après MM. Ch. Alluaud et R. Jeannel, se rencontrent dans les régions montagneuses dont le climat est plus frais : forêts inférieures du Kénya et du Kilimandjaro, et sommet du Maü Escarpment. Ces constatations sont d'ailleurs d'accord sur ce point avec Borchmann, qui dans son étude des Résultats de l'Expédition zoologique du Dr Sjöstedt au Kilimandjaro, au Meru et aux steppes du Massaï, déclare, précisément à propos des *M. monticola* et *M. atrocyaneus* rencontrés en assez grand nombre par ce naturaliste à Kibonoto, zone des cultures du Kilimandjaro, qu'il est surprenant de rencontrer des Méloés aussi près de l'équateur. Mais cela s'explique, dit-il, par ce fait que leurs représentants ne paraissent pas descendre au-dessous de 1300 mètres d'altitude, et qu'ils s'élèvent jusqu'à 3500 mè-

tres. Il semble donc que les trois espèces rencontrées par MM. Ch. Alluaud et R. Jeannel dans leur exploration seraient à éliminer.

Il en est sans doute de même des espèces de la Colonie du Cap de Bonne-Espérance, décrites par Peringuey, en raison de leur habitat lointain. Il ne resterait plus ainsi qu'un petit nombre d'espèces pouvant revendiquer la larve en question, c'est-à-dire le *Meloe herero* du Damaraland, le *M. Seineri* du Bechuanaland, et le *M. ukinganus* des territoires situés au nord du lac Nyassa. Les deux premiers habitent des régions méridionales très éloignées, et sont probablement hors de cause. Serait-ce le *Meloe ukinganus* qui se rencontre au nord du lac Nyassa ? ou bien le *M. Chevrolati* qui d'après Fairmaire pourrait se retrouver dans le centre du continent africain ? On ne peut faire aucune supposition avec des chances sérieuses d'être dans le vrai.

Quant à la question que soulève la rencontre fréquente de cette larve sur *Anthia cavernosa*, l'opinion de Gerstaecker qui admet qu'il s'agit là d'une erreur de l'instinct peut se soutenir avec assez de vraisemblance. Cependant la répétition de cette découverte sur de nombreuses *Anthia cavernosa*, puisque Gerstaecker dit que la plupart de ces insectes capturés à Mombasa et au lac Jipé en étaient porteurs, et dans des régions différentes fort éloignées les unes des autres, pourrait constituer autre chose qu'une simple coïncidence fortuite de cas accidentels. Mais pour en juger, il faudrait mieux connaître les mœurs de ce Carabique. Or jusqu'ici l'on ne sait que fort peu de choses à ce sujet, et il est impossible d'en déduire une conclusion quelconque permettant d'expliquer cette phorésie inattendue.

Un premier point à éclaircir est le suivant : les larves des Méloés écloses des pontes déposées dans le sol, grimpent sur les plantes et se mettent en embuscade dans les fleurs pour y guetter les Hyménoptères mellifères qui viennent butiner. Quand l'un d'eux survient, elles se précipitent sur lui, se fixent à sa toison, et se font transporter par cet hyménoptère dans son nid où elles se développent en parasites. Où les *Anthia* rencontrent-elles les larves méloïdes en question ? Les gros Carabiques n'ont en général guère l'habitude de grimper sur les plantes en fleurs ; les *Anthia* du nord de l'Afrique ne paraissent pas avoir semblable coûtume. On peut dès lors se demander si l'*Anthia cavernosa* se comporterait autrement. Eh bien ! oui. M. Ch. Alluaud m'a appris que ces insectes grimpent sur les arbres, et m'a fait part de son étonnement lorsqu'il avait vu à Mombasa, en septembre, en plein soleil, un de ces insectes tomber dans son parasol. Nous savons par ailleurs que des larves de *Meloe* de deux espèces différentes ont été rencontrées au Maroc par MM. Ch. Rungs et Lespès blotties dans les fleurs des orangers. Ainsi peut s'expliquer la présence de notre larve sur l'*Anthia cavernosa*, insecte pubescent, qu'elle peut rencontrer soit sur des fleurs développées au ras du sol, soit même sur des arbres.

Un deuxième point auquel il est plus difficile de donner une réponse

satisfaisante est celui de savoir si réellement l'*Anthia cavernosa* peut conduire au gîte aux vivres les larves qu'elle transporte. Les *Anthia* qui vivent en Algérie sont des insectes carnassiers, se nourrissant de proies vivantes, habitant des régions sub-désertiques plus ou moins arides, souvent sablonneuses ; les unes manifestent leur activité durant la nuit (*A. venator* Fabr.), d'autres au contraire durant le jour (*A. sexmaculata* Fabr.). L'*Anthia cavernosa* qui est diurne, d'après des renseignements fournis par M. Ch. Alluaud, fréquente des régions privées d'eau, non sablonneuses, mais nullement arides, recouvertes au contraire d'essences épineuses : telle est le " Pori di Seringheti », région de steppes chauds dont l'altitude varie entre 600 et 1200 mètres, où M. Ch. Alluaud l'a rencontrée en abondance en même temps que de nombreux Méloïdes : *Cyaneolytta*, *Mylabris*, etc. Si cette *Anthia* grimpe sur les arbres, ce ne peut être, à mon avis, que pour y rechercher sa nourriture. Quelle espèce de gibier peut-elle chasser ? Y poursuit-elle des chenilles, comme les *Cerocoma* de nos pays ? Selon toute probabilité ce gibier ne conviendrait guère à notre larve. S'attaquerait-elle au contraire au couvain de certains Hyménoptères qui établissent leurs cellules dans des galeries creusées dans des troncs d'arbres, comme le font par exemple les Xylocopes, connues pour héberger les *Horiini* ? En ce cas les larves en question pourraient peut-être profiter de cette particularité pour s'introduire dans les galeries de l'hyménoptère, où elles trouveraient une nourriture appropriée à leurs besoins.

Toutes les suppostiions sont permises, mais ce ne seront jamais, il ne faut pas l'oublier, que des suppositions absolument gratuites tant qu'elles ne reposeront pas sur des faits avérés et bien contrôlés.

Quoi qu'il en soit, si l'on a obtenu tout dernièrement au Vivarium du Museum National la larve d'une espèce algérienne d'*Anthia* (*A. sexmaculata* Fabr.), on n'a pu arriver à savoir de quoi elle se nourrissait. M. Lucien Choppard, qui a observé et décrit cette larve, a émis dubitativement l'hypothèse qu'elle avait peut-être pu se développer aux dépens de jeunes Blattes qui avaient envahi la cage d'élevage. En admettant que cette hypothèse soit l'expression de la réalité, et que les *Anthia cavernosa* se développent elles aussi aux dépens de jeunes Blattes ou de quelque autre Orthoptère, cela ne nous apporterait probablement aucun élément nouveau d'information pouvant nous aider à trouver la solution du problème qui nous occupe.

La microphotographie qui figure dans ce travail est celle de la larve du British Museum provenant de la région du lac Nyassa (Grt × 50). Elle a été exécutée par les soins des Etablissements Cogit, 36, Boulevard Saint-Michel, Paris.

BIBLIOGRAPHIE.

H. Beauregard. — Les Insectes Vésicants, 1890, p. 457.

F. Borchmann. — Wissenschaftliche Ergebnisse der schwedischen zoologischen Expedition nach dem Kilimandjaro, dem Meru und den umgebenden Massaisteppen Deutsch-Ostafrikas 1905-1906 unter Leitung von Prof. Dr. Yngve Sjöstedt, 7. Coleoptera 14, Lagriidae and Cantharidae, 1909, p. 301.

F. Borchmann. — Coleopterorum Catalogus auspiciis et auxilio W. Junk editus à S. Schenkling, Pars 69 : Meloidae, Cephaloidae, 1917.

F. Brauer. — Ueber die Verwandlung der Meloiden, *Verhandl. Zool. Bot. vereins in Wien*, t. XXVII, 1887, pp. 633-642.

L. Chopard. — La larve de l'*Anthia sexmaculata* F., *Bull. Soc. Ent.* Fr., t. XLI, No. 10, 1936, pp. 168-173, 9 figs.

A. Cros. — Forme des ongles des larves primaires des *Meloïdae* et valeur du terme « Triongulin », *Ann. Soc. Ent. Fr.*, vol. LXXXVI, 1917, pp. 159-164, 5 figs.

A. Cros. — Notes sur les larves primaires des *Meloidae* (1ère Série), *Ann. Soc. Ent. Fr.*, vol. LXXXVIII, 1919, pp. 261-279; (2e Série), *Ann. Soc. Ent. Fr.*, vol. XC, 1921, pp. 133-155; (3e Série), *Ann. Soc. Ent. Fr.*, vol. XCVIII, 1929, pp. 193-222.

A. Cros. — Observations nouvelles sur les Méloés, *Ann. Sc. Nat., Zoologie*, t. XII, 1929, pp. 137-191, 2 figs.

A. Cros. — Biologie des Méloés, *Ann. Sc. Nat., Zoologie*, t. XIV, 1931, pp. 189-227.

A. Cros. — Les larves primaires des *Meloidae*, *Ve Congrès International d'Entomologie, Paris* 1932, pp. 101-108.

A. Cros. — Description d'une larve primaire de Méloé de provenance marocaine et d'espèce inconnue. — Note additionnelle sur une larve primaire de Méloé trouvée au Maroc, présentant les caractères du *Meloe violaceus* Marsh., *Bull. Soc. Sc. Nat. Maroc*, t. XV, 2e trim., 1935, pp. 1-10, Pl. II.

Gerstaecker. — Baron von der Decken's Reisen in Ost-Afrika. Die Gliederthiere Fauna des Sansibar Gebietes. *Archiv f. Naturgesch.*, 1873, III B., 2 Abth., pp. 212, Taf. XI, fig. I.

G. Hachfeld. — Ueber die Biologie und Metamorphose einer bei *Trachusa serratulae* Pz. schmarotzenden Meloide, mit 8 Abbild., *Zeitschrift für wissenschaftliche Insektenbiologie*, Bd XXIII, Nr 8.-9, pp. 177-190, v. 31.X.1928.

G. Hachfeld. — Ueber die Primärlave der *Meloe brevicollis* Pz., und über die bis jetz bekannten Primärlarven deutscher Meloiden, mit 4 Abbild., *Zeitschrift für wissenschaftliche Insektenbiologie*, Bd. XXVI, Nr. 2-3, pp. 42-47, v. 15.V.1931.

R. Jeannel. — Sur les mœurs de l'*Anthia venator* en captivité, *Bull. Soc. Ent. Fr.*, 1907, No. 17, pp. 292-293.

M. Pic. — Voyage de Ch. Alluaud et R. Jeannel en Afrique orientale, 1911-1912, Coléoptères, III, *Meloidae*, pp. 132-133.

Zur Kenntnis der Malacodermata Aegyptens

(9. Beitrag zur Kenntnis der palaearktischen Malacodermata)

von W. Wittmer, Zürich.

Die nachstehend zur Beschreibung gelangenden Arten entstammen einer Bestimmungssendung, die mir von Herrn A. Alfieri, General-Sekretar der Société Royale Entomologique d'Egypte, Cairo, zugegangen ist. In zuvorkommender Weise überliess mir Herr Alfieri Belegexemplare von *Attalus mitlaensis* ♀, *Malachius fourtaui* Pic ♀, und *Haplocnemus suggara* subspec. *alfierii*. Die Sendung enthielt ausserdem 1 ♀ des *Psiloderes sinaiticus* Wittmer Fundort: Wadi el Gederat (Sinai), 13.3.1937 (leg. A. Rabinovitch) und 1 ♀ des *Malachius abdominalis* F. vom gleichen Fundort.

Cantharidae

Malthodes aegyptiacus nov. spec.

♀. — Einfarbig schwarz, nur die Flügeldecken mit einem schmutziggelben Apikalflecken versehen und die Mandibeln gelblich.

Kopf etwas länger als breit, mit den Augen so breit wie der Halsschild, mikroskopisch skulptiert, staubartig, spärlich behaart. Augen mittelgross, schwach hervortretend, Längsdurchmesser so lang wie die Schläfe. Fühler von halber Körperlänge, erstes Glied etwas länger als das 2., leicht nach aussen gebogen, 2. und 3. Glied unter sich gleich lang, jedes fast doppelt so lang wie breit, 4. und folgende Glieder bis zum 10. kaum wahrnehmbar länger als das 3., 11. länger als das 10. Die Fühlerglieder sind verhältnismässig dick, bis zum 7. ungefähr gleich briet, 8. und folgende jedes etwas schmäler, Endglied am dünnsten. Halsschild etwas breiter als lang, nach vorne leicht verschmälert, ohne abgesetzte Randung und Erhebung, auch die Vorderecken sind nicht wulstartig erhoben; fast glatt, staubartig, spärlich behaart. Flügeldecken breiter als der Kopf und Halsschild, stark verkürzt, halb so lang wie die Flügel, klaffend, runzlig gewirkt, staubartig behaart. — Länge: 3,8 mm.

Fundort: Ikingi Mariout (Aegypten), 10.6.1936, leg. A. Rabinovitch. — Type in coll. A. Alfieri, Cairo.

Von *Malthodes alfierii* Pic, der auch aus Aegypten beschrieben ist, unterscheidet sie sich durch grössere Gestalt, einfarbig schwarzen Kopf, stark verkürzte Flügeldecken und glatten Halsschild. Letztere beiden Merkmale, zusammen mit den verhältnismässig breiten Fühlern, deren vier letzte Glieder wieder etwas verschmälert sind, charakterisieren die Art gut.

Malachiidae

Attalus mitlaensis nov. spec.

♂. — Körper dunkelgrün, metallisch glänzend, Halsschild orange mit breitem, medianem, schwarzgrünem Längsband. Fühler dunkel, 3-4 Basalglieder mehr oder weniger aufgehellt (rötlich). Oberlippe gelblich. Beine dunkel, Vorder- und Mitteltarsen und manchmal auch die Vordertibien, besonders in der Nähe des Knies, etwas aufgehellt.

Kopf breiter als lang, mit den Augen wenig schmäler als der Halsschild, fast glatt, zwischen den Augen mit 2 undeutlichen Längseindrücken, Behaarung greis. Fühler von Körperlänge, 2. Glied knötchenförmig, halb so lang wie das 1., 3. Glied 1½ mal so lang wie das 2., zur Spitze nach innen leicht verdickt, 4. Glied dem 3. in der Form ähnlich, jedoch eine Spur länger, 5. und 6. Glied unter sich gleich lang, jedes ungefähr so lang wie das 2. und 3. zusammen, zur Spitze nach innen leicht verdickt, 7. kaum länger als das 6., auf der Aussenseite, der ganzen Länge nach, schwach ausgebuchtet, 8. bis 11. fadenförmig, jedes so lang als das 7. Halsschild etwas breiter als lang, alle Ecken verrundet, Hinterecken etwas stärker verrundet als die Vorderecken, wodurch der Halsschild zur Basis leicht verengt erscheint, wenig tief und wenig deutlich, zerstreut punktiert, Behaarung greis, kurz und fein, mit nur vereinzelten längeren, dunklen Haaren. Flügeldecken breiter als der Halsschild, reichlich doppelt so lang wie an den Schultern breit, zur Spitze nur wenig verbreitert, runzlig gewirkt, Behaarung dunkel, nur spärlich mit abstehenden, längeren Haaren besetzt.

♀. — Gestalt gedrungener, Halsschild einfarbig rotorange. Fühler kürzer, Basalglieder weniger stark aufgehellt, manchmal ist nur die Unterseite der 3 ersten Glieder aufgehellt.

Länge: 2,8-3,0 mm.

Fundort: Wadi Um-Mitla 12.-14.3.1937; Wadi el Gedeirat 13.3.1937 (Sinai), leg. A. Rabinovitch. — Type in coll. A. Alfieri.

Nahe verwandt mit *Attalus leptocephalus* Ab. von der sie sich wie folgt unterscheidet.

A. leptocephalus Ab.	*A. mitlaensis* mihi
♂ Halsschild einfarbig rot.	♂ Halsschild rotorange mit einer dunkeln, medianen Längsbinde.
Fühler kürzer als der Körper.	Fühler so lang wie der Körper.
Halsschild und Flügeldecken reichlich mit langen, schwarzen, abstehenden Haaren besetzt.	Halsschild und Flügeldecken spärlich und mit kürzeren, schwarzen, abstehenden Haaren besetzt.

Die Weibchen sind weniger leicht auseinanderzuhalten, weil der Hals-

schild bei beiden einfarbig rot oder rotorange gefärbt ist. Ausser den längeren Fühlern bei *mitlaensis* ♀ sind auch hier Halsschild und Flügeldecken spärlicher und mit kürzeren, schwarzen abstehenden Haaren besetzt als bei *leptocephalus* Ab.

Attalus mitlaensis m. ist die zweite in Aegypten vorkommende *Attalus*-Art bei der in der Färbung des Halsschildes ein Geschlechtsdimorphismus auftritt. Von der ersten, *Attalus schatzmayri* Wittmer, unterscheiden sich die ♂ durch den orangeroten mit einer dunkeln Mittelbinde versehenen Halsschild, der bei *Attalus schatzmayri* einfarbig dunkelgrün ist, ausserdem sind die Fühler bei dieser Art bedeutend kürzer als bei *Attalus mitlaensis*.

Malachius fourtaui Pic.

Herr A. Rabinovitch erbeutete anlässlich einer Exkursion nach verschiedenen Wadis der Sinaihalbinsel, im März 1937, eine ganze Serie dieser bisher nur im ♀ Geschlecht bekannten Art. Unter den mir vorliegenden Stücken befand sich auch ein ♂. Zur Vervollständigung der Beschreibung Pic's (Bull. Soc. Ent. Egypte 1920, 42) ist zu erwähnen, dass die Fühler der ♂ vom 5. Gliede an stark gekämmt sind. Schon das 2. Glied zeigt die Tendenz zur Lamellenbildung durch eine knopfförmige Verdickung an der Innenseite an, beim 3. und 4. Gliede sind diese stumpfen Fortsätze etwas länger, ohne jedoch die erst beim 5. Gliede beginnende lamellenförmige Bildung zu zeigen. Die Makeln auf den Flügeldecken sind beim ♂ heller als beim ♀. Die Schultermakel ist bedeutend länger, sie erreicht auf der Seite fast die Apikalmakel. Spitzen der Decken eingedrückt. Anhängsel nebst Grund des Eindruckes olivgrau gefärbt. Der Anhängsel besteht jederseits aus zwei übereinanderstehenden, ziemlich schmalen Fortsätzen, deren oberer länger und dünner und dessen Spitze leicht nach unten gekrümmt ist.

In der Fühlerbildung hat die Art grosse Aenlichkeit mit *M. sexplagiatus* Ab. (in deren Verwandtschaft sie Pic schon stellt). Die Färbung der Decken und die Disposition der Vordermakeln, die orangerot gefärbt und auf die Schultern beschrängt sind, unterscheiden sie hinlänglich von *fourtaui* Pic deren Makeln weisslich sind und sich am Seitenrande weit nach hinten erstrecken.

Dasytidae

Haplocnemus (*Ischnopalpus*) *suggara* subspec. *alfierii* nov.

Die Beschreibung von Herrn de Peyerimhoff (Bull. Soc. ent. France 1929, 193) passt auffallend auf die mir vorliegenden 3 Exemplare folgenden Fundorts : Wadi El Gederat, 13.3.1937 (Sinai). Die geringere Grösse (3,5-5,0 mm.) und die weniger stark gesägten Fühlerglieder des ♂ unterscheiden sie von der Stammform. Das 2. knötchenförmige Fühlerglied (♂) ist rötlich (bei der f.t. dunkel), das 3. Glied ist länglich, etwas länger als das 4., nach innen stumpfwinklig, schwach erweitert, 4.-10. Glied gesägt, fast so breit

wie lang, 11. spindelförmig, fast so lang wie die beiden vorhergehenden zusammen. Behaarung des ganzen Körpers lang und ziemlich dicht, gelb, auf dem Kopf und Halsschild sind die gelben Haare mit einigen längeren, dunkeln untermischt.

Séance du 13 Octobre 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Dons à la Bibliothèque :

La Société a reçu les ouvrages suivants :

1° De Monsieur A. Carneri, d'Alexandrie : un volume « Histoire Naturelle des Trochilidae », par E. Simon, 1921, Paris.

2° De Monsieur le Docteur Guido Paoli, de Gênes : 3 separata de ses récents travaux entomologiques publiés dans « Redia », 1937.

3° De Monsieur W. J. Hall, de Mazoe (Rhodésie du Sud) : un exemplaire du Rapport Annuel de la Station Expérimentale de Mazoe (publication No. 5, 1936).

4° Des Trustees du British Museum (Natural History), de Londres : un volume « Bombyliidae of Palestine », par E. E. Austen, 1937, Londres.

5° De Monsieur le Docteur Auguste Cros, de Mascara (Algérie) : un separata de chacun de ses 5 récents travaux entomologiques.

Le Conseil remercie.

Nomination :

Sur la proposition de Messieurs le Professeur H.C. Efflatoun Bey et Anastase Alfieri, Monsieur Abdel Aziz Loutfy, professeur d'Entomologie à l'Ecole d'Agriculture de Chebin El Kom (Basse-Egypte), est admis à faire partie de la Société en qualité de membre titulaire.

Démission :

Monsieur le Docteur Ernest Hess, du Caire, fait parvenir sa démission.

Nécrologie :

Le Secrétaire Général fait part du décès des regrettés collègues dont les noms suivent :

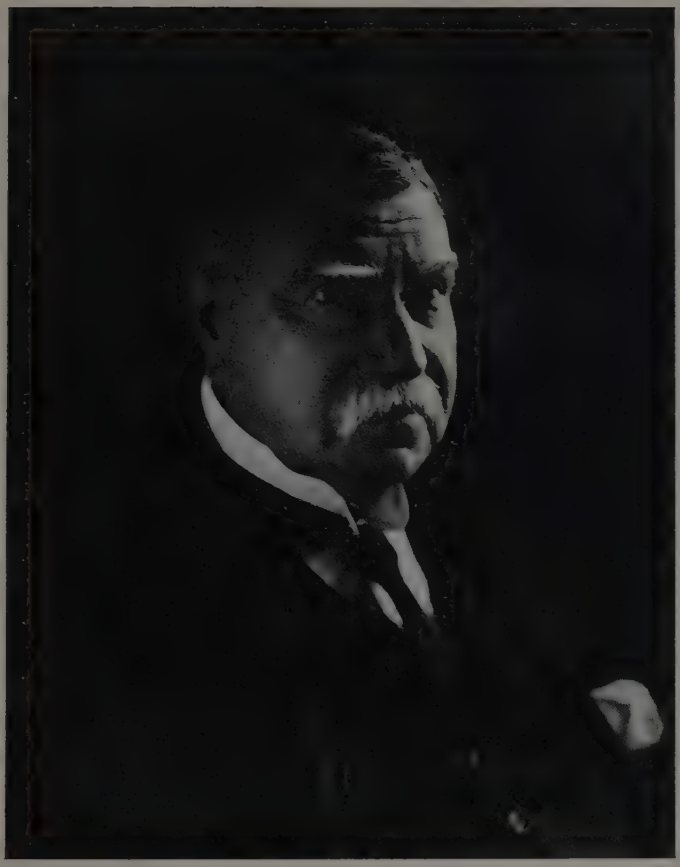
Walter Farncis Innes Bey, membre fondateur, membre bienfaiteur et vice-président honoraire de la Société, décédé à Alexandrie dans sa 79ème année.

Hugo Lindeman, membre bienfaiteur, décédé à Alexandrie le 29 Avril 1937.

Paolo Luigioni, de Rome, qui avait été nommé membre correspondant de la Société en 1934.

Lord Rothschild, de Tring, membre honoraire de la Société depuis 1909.

Geza Horvath, membre honoraire de la Société.



Docteur Walter Francis Innes Bey
1858-1937

L'entomologie vient de perdre un de ces hommes qui, non seulement l'honorent par leurs talents, par une vie de labeurs dans le champ de la science et par leurs ouvrages, mais encore par leur zèle et un dévouement de tous les instants à l'étendre et à la propager en lui créant de nouveaux séides. Walter Francis Innes est mort le 28 Avril 1937, à Alexandrie où il s'était fixé depuis 1934.

Né à Alexandrie, le 7 Octobre 1858, d'une famille d'origine écossaise, Walter Francis Innes fit de solides études sous la direction d'un précepteur qui sut, également, lui inculquer l'amour des sciences naturelles. Quelques

années plus tard, Walter Francis Innes quittait la Faculté de Lyon muni de son diplôme de Docteur en Médecine.

En 1885, Walter Francis Innes était nommé bibliothécaire et conservateur du Musée des Sciences Naturelles de l'Ecole de Médecine de Kasr el Aini, fonctions qu'il remplira avec zèle et dévouement jusqu'en 1918, soit pendant 33 années consécutives, tout en exerçant sa profession de médecin.

Malgré les soucis de ses multiples occupations, Walter Francis Innes trouvera toujours le temps d'endosser son sac de naturaliste. Son zèle, son ardeur pour la science, lui fit entreprendre des voyages pénibles : il a visité le Sinaï, le Soudan et l'Erythrée, à une époque où les moyens de transport étaient bien précaires. Il a rapporté, de ses voyages, des richesses sans nombre. Son cabinet du Square Halim était toujours ouvert avec empressément cordial à tous ceux qui voulaient s'instruire ; sa bibliothèque, ses matériaux d'étude étaient à leur disposition.

Le 1er Août 1907, Walter Francis Innes figure sur la liste des fondateurs de la Société Royale Entomologique d'Egypte. En 1927, ses collections viennent enrichir notre Musée et divers ouvrages notre Bibliothèque. A la suite de ces dons, la Société lui confère le titre de membre bienfaiteur.

Walter Francis Innes était, au moment de sa mort, vice-président honoraire de notre Société et, outre le grade de Bey conféré par le Gouvernement Egyptien pour services rendus, il possédait 3 décorations qui lui avaient été décernées par l'Egypte, la France et la Suède.

The Cotton Green Bug, *Nezara viridula*, L. and its important Egg-Parasite, *Microphanurus megacephalus* (Ashmead)

(Hymenoptera-Proctotrupidae)

(with Plates VII-XI)

by Mohamed Kamal, B.A., M.S., Ph.D.

INTRODUCTION

The Cotton Green Bug, *Nezara viridula* L. (Plate VII, fig. 1) is a very common insect in Egypt found associated with cotton and a wide list of different plants. Its remarkably disguising color which generally harmonises with the surroundings helps the insect to escape the casual observer, thus making the damage caused by its presence to be overlooked or perhaps attributed to other pests.

Occasionally, however, the bug proves to be troublesome on cotton by causing injury to the plants not only through direct feeding and the shedding of squares and blossoms but also by carrying disease through punctures made by their long beaks.

In fact, this insect in Egypt as compared in other countries is recognised to be a pest of minor importance. That this insect is not a serious pest here, is due to the efficacy of its Proctotrupid parasite which keeps the insect well under control. The rate of reproduction of the bugs is so great and the mortality among the stages is so small that, evidently, one would think that if they are not held under check by natural agencies they would undoubtedly cause untold damage to the plants on which they feed.

The studies and observations reported in this paper started at the end of 1933 with the objective of knowing the status of the bug from an economic standpoint, the important natural enemies throughout the area of distribution and to what extent these natural agencies can serve as means of control.

ACKNOWLEDGMENTS

I must admit that the short notes published by Prof. Dr. H. Priesner (1) on the expected economic importance of *Microphanurus* gave me a great impetus to start this biologic study.

(1) See *Bull. Soc. Roy. Ent. d'Egypte*, 1931, fasc. 3-4, pp. 137-139.

The writer is also indebted to Dr. H. L. Parker of the European Parasite Laboratory, United States Bureau of Entomology, whose personal assistance and valuable suggestions in the technique and preparation of the immature forms of the parasite were essential in developing a method of dissecting which helped to overcome the intricacies of such a delicate problem.

To my assistant Abd El-Fattah El-Moursy (B. S., Cairo University), and to my laboratory operator Abd El-Monem, I should express my thankfulness.

BIOLOGY OF THE COTTON GREEN BUG

Distribution

The Cotton Green Bug is practically a cosmopolitan insect occurring chiefly in the temperate zones of the northern as well as the southern hemispheres.

In Egypt the insect is widely spread all over the country, as our records indicate its presence from the Mediterranean coast to Assuan. It is, generally speaking, by no means abundant and considerable search is required before one is able to collect an appreciable number on several host plants.

Seasonal Abundance

Though adult bugs can be found the year round, it is apparent that there is a distinct seasonal abundance beginning from April and reaching its maximum during September. In this respect, we found that the records of the breeding cages coincide exactly with the data collected from the field.

In November, however, as the temperature falls, adult bugs can be seen to congregate together preparing for overwintering among the foliage of the trees. Egg laying also diminishes till it entirely ceases before the end of the month both in the laboratory and in the field.

Feeding Habits and Host Plants

The green bugs are reputed to be general feeders subsiding on the juices of a long list of over sixty or more unrelated species and varieties of plants. The insect has been observed to breed in Egypt on plants such as citrus, turnips, tomatoes, legumes, oleander, hibiscus, castor oil, sesame, lablab, guavas, mulberry, cereals and several others. There is no indication that it displays any particular preference to one plant over the other.

The bugs feed on various parts of the plant by inserting their long beaks into the leaves, petioles, squares, and green cotton bolls, thus causing the tissues to turn yellowish and often leaving blotches as a result of the feeding punctures.

Type and Extent of Damage

The damage done to cotton by the green bugs is really insignificant except under certain conditions near the northern coast when the humidity goes very high. Under these circumstances the attack is often associated with the wound fungus, *Rhizopus nigricans* which is fairly common in these localities. The bugs in this case help as disseminators of the parasite which cause the internal rot of the green bolls.

As the disease is also correlated with other species of bugs and several biting insects, it remains to be investigated the exact percentage of damage attributed to this species alone and to what extent the fungus can also affect the cotton fields of middle and lower Egypt.

The entrance of the mouth parts in the carpel walls of the bolls or in the leaf tissue is marked by minute dark spots which show very readily when brought against light. In young bolls and buds the spots coalesce, thus increasing in area and causing the bolls to drop off. If some of these small bolls are split open, they show internal proliferation at the point of entry of the beaks. Mature bolls, however, do not drop off but dry up and split prematurely.

Serious damages this year, 1937, were reported in a farm at Shubra near Cairo, where the bugs had destroyed a two-acre garden of tomatoes. The almost ripe fruits were badly disfigured by the sucking beaks of the bugs and the green ones were hard culls fit for nothing. The plants were very much stunted in growth and their color changed yellowish.

The tomatoes were neighboring to a field of wheat and when the latter was ready to be harvested, the bugs migrated to the tomatoes and multiplied in myriads which caused total loss to the tomato field.

LIFE-HISTORY STUDIES

Copulation

Adults with the advent of warm weather in March leave their winter quarters and disperse in the fields in response to higher temperature which stimulates their activities. On hot days, the bugs display extreme activities, copulate readily and are seen flying from plant to another. Whereas in very hot and dry weather, the insects seek retreat under cover or in shady haunts on the plant in order to pass the hot part of the day.

Copulation takes place any time of the day and lasts on the average for 23 hours. A mated female is also seen to copulate more than once with the same male or with other males.

Oviposition

Four or five days after mating the female begins to lay her eggs, which

repeated observations indicate that they are generally deposited late at night and in the early hours of the morning i.e. between 11 p.m. and 3 a.m. on the under side of the leaves (Plate IX, fig. 17).

The female protrudes her ovipositor to lay her first egg which takes a much longer time (about 3-4 minutes) and then the rest of the egg mass follow one after the other until the whole quota of eggs is laid in a period 20-30 minutes.

Oviposition period extends from the middle of March till the middle of November reaching its peak in September. In the laboratory the earliest eggs were laid the last week of February and the latest date about the end of November.

A single female is capable of laying three masses during her life at intervals of five days. There is a wide variation in the number of eggs of each mass, but generally the average varies from 40 to 70. It is occasionally observed that exceptional egg clusters contain a maximum number of 202 and a minimum of three. As a rule, the eggs in each successive mass decrease in number to almost two-thirds that of its preceding.

STAGES OF DEVELOPMENT

The Eggs

The egg batches which are rectangular in form, are laid by the females on the underside of the leaves securely cemented to the surface.

Eggs are deposited first in one row and then uniformly arranged one next to the other as seen in Plate IX, fig. 18.

Eggs (Plate VII, figs 2 and 3) are usually barrel-shaped with very tough chorion. When freshy laid they are yellowish white measuring 1.2 mm. in length and 0.75 mm. in diameter. There is a brownish ring encircling the outside of the egg cap, whereas another ring of tiny white elevations is visible on the inside. The whole surface of the egg is marked with very fine transparent specks. Fertility is very high among the eggs and seldom eggs are laid infertile. The latter can be distinguished with their purple lustrous appearance.

Adult bugs kept in confinement for long time develop cannibalistic habits by sucking the contents of their own eggs. In this case the empty eggs look very much like the infertile ones with the addition of a small whitish conical feeding tube on top of the cap as seen in Plate VII, fig. 4.

Fertile eggs display peculiar characters as the development of the embryo proceeds. They show V-shaped pinkish marking and spots on the cap which continue until the first nymph appears (Plate VII, figs 5 and 6).

The incubation period of the eggs varies according to the season. In the fall it may last for eight days while in summer the average period is four days.

The Nymphal Stages

There are five distinct nymphal stages of development. Each stage is characterised by marked variation in the shape, color patterns and number of spots found on the thorax and abdomen. The writer is not inclined to go into lengthy descriptions of these variations in each stage since they are self-explanatory in the accompanying Plates.

First Nymphal Stage

The first nymphal stage is gregareous in habits (Plate IX, fig. 17) and the individuals are very soft and delicate. Most peculiar about this stage is that the individuals undergo marked changes in color and size as shown in Plate VIII, figs 10, 11 and 12; but in all these changes the main shade of color remains the fawn.

The average dimensions of the young nymphs in this stage are as follows :

a. Newly hatched, 1.3 mm. long and 1.0 mm. wide (Plate VIII, fig. 10).
b. 24 hours old, 1.8 mm. long and 1.3 mm. wide (Plate VIII, fig. 11).
c. 72 hours old, 1.9 mm. long and 1.3 mm. wide (Plate VIII, fig. 12).

From these dimensions one can easily see that the young approximately doubles its length at the end of the stage; while in width it remains almost constant.

The explanation of this phenomenon lies in the formation of the lateral sclerites which are closely folded together in the newly hatched nymphs as seen in the bodycreases of figure in Plate VIII, fig. 10. These lateral pleurae gradually unfold as the nymph grows, thus causing the insect to change in size.

The Other Nymphal Stages

The second and third nymphs look closely alike and only different in the sizes of the thorax and abdomen and the color of the ventral spots as shown in Plate VIII, figs 13 and 14.

These two stages, however, vary in their appearance from the fourth and fifth which bear great resemblance to each other as seen in Plate VIII, figs. 15 and 16.

The dimensions of these stages are as follows :

2nd stage 2.2 mm. long and 1.5 mm. wide; 3rd stage 3.5 mm. long and 1.75 mm. wide; 4th stage 5.5 mm. long and 4.9 mm. wide; 5th stage 10 mm. long and 8 mm. wide.

Examples of measurements of the antennal joints in the larval stages of *Nezara viridula* L. in mm. are given in the following Table :

STAGE	JOINT I	JOINT II	JOINT III	IOINT IV
I	0.100 to 0.126	0.165 to 0.210	0.147 to 0.168	0.330 to 0.406
II	0.247 to 0.264	0.445	0.360	0.560 to 0.595
III	0.297 to 0.330	0.726 to 0.760	0.560 to 0.610	0.850 to 0.860
IV	0.460	1.220 to 1.250	0.850 to 0.910	1.050 to 1.120
V	0.490 to 0.53.	1.840 to 2.050	1.410 to 1.490	1.410 to 1.450

LIFE CYCLE AND NUMBER OF GENERATIONS

The total life cycle of the five nymphal stages of development averages about 45 days during optimum conditions, i.e., during August and September. In the spring (February, March and April) however, the complete development from egg to adult requires 60 days, while in summer it drops to 53 days or more.

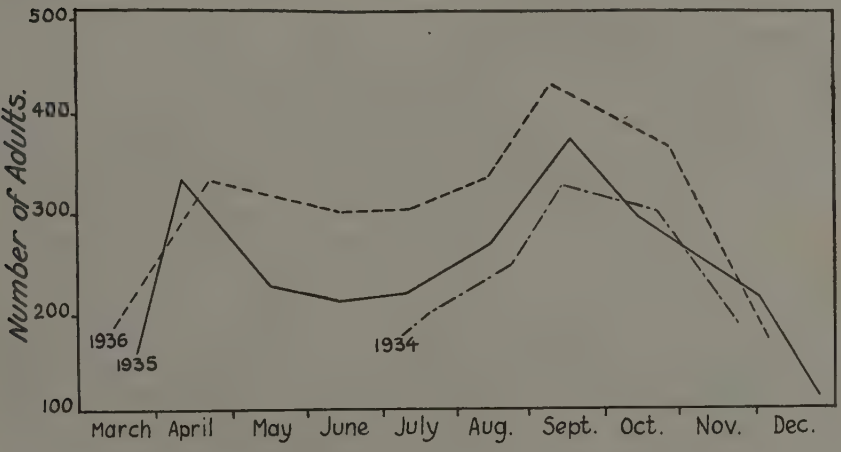
The number of stages and the average length of each is shown in the Table hereafter. The mean temperature during this period was 26° C. and the relative humidity was 54%.

MONTHS	INCUBATION	1st	2nd	3rd	4th	5th	TOTAL NUMBER OF DAYS
April	6	4	10	8	11	19	58
	6	4	9	9	11	18	57
	6	4	11	9	11	17	58
May	6	4	13	9	11	14	57
	7	4	9	11	12	13	56
	6	5	9	8	13	12	53
June	7	5	10	10	11	12	55
	7	4	10	10	11	16	58

Notwithstanding the overlapping of generations, the interpretation of accumulated data during the last three years indicate the presence of three generations a year from March to November.

Adult bugs appearing in November enter into hibernation and are often seen congregating in groups among the foliage of trees, under the bark and among the weeds on the banks of irrigation canals.

The Diagram below shows the Seasonal Abundance of the Bugs.



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BIOLOGY OF MICROPHANURUS MEGACEPHALUS (ASHMEAD)

Introduction.

The Green Cotton Bug, *Nezara viridula* L. (Plate VII, fig. 1) is not considered a pest in this country, although it has occasionally been reported to occur in sudden outbreaks. The existence of such periodical abundance makes one inclined to believe that the bugs are being kept under control by natural factors. It was thought that the undue increase in numbers should be conductive to serious damages to the plants. This, fortunately, was avoided in our particular case due to the presence of an efficient egg parasite which kept the pest always under check.

The cumulative results of the investigations carried out by the writer for the last four years substantiate this belief. It was first believed that a number of interrelated biologic factors must be concerned in subduing the

increasing population of the *Nezara*, but finally we became convinced that only one species of parasite is responsible for this decline in importance.

This black Proctotrupid, *Microphanurus megacephalus* (Ashmead) (2), which breeds throughout the summer in a succession of short cycle generations is the parasite responsible for destroying the majority of the egg-clusters which reach their maximum production from June to October as seen in the preceding Diagram. It was also found that this period coincides with the time in which the parasite breeds in excessive numbers. It is only natural that this preponderance in host material should result in a rapid multiplication of the natural enemy.

Shipping the Parasite

The statement published by Prof. H. Priesner in 1931 on the economic bearing of the parasite in Egypt and the prospects of its introduction into foreign lands stimulated interest of Entomologists in far distant countries where the bugs play an important role as economic field pest. The first enquiry came to us in the year 1932 from the entomologist of the Government of Western Australia requesting us to help him in the introduction of the parasite.

As the air service had not yet been established between our respective countries, the only route available was the long sea journey which takes about 30 days between Port Said and Perth. There arose, therefore, the question of preserving the adults as well as the parasitized eggs long enough to reach their destination in good condition, and this evidently required a very careful study of all the factors envolved.

As a first trial, a consignment was shipped in July, 1933 and the parcel was entrusted to the chief officer on board who arranged to keep the box in the vegetable chamber of the steamer, the temperature of which ranged between 8-10° C. Parasites were shipped as immature forms mostly in the pupal and last larval stages; likewise few adults about to emerge from the host eggs were also included. Reports from Australia on this shipment indicated that the parasitized eggs carried fairly well and that several parasites had issued during transit and only a few arrived alive.

A second consignment followed the first in October of the same year. A new system was followed this time; parasitized eggs at various intervals together with some freshly emerging adults and egg masses near hatching, were contained in the shipment. Mr. Newman, the State Entomologist, in reporting on this last sending stated that it arrived in very fair condition. He further declares that the value of this parasite, should he succeed in its

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(2) A good drawing of this insect is given in *Bull. Soc. Roy. Entom. d'Egypte*, 1931, fasc. 3-4, pp. 138-139, figs 1-3.

permanent establishment, will be very great, as the green bug, *Nezara viridula*, constitutes one of the major insect pests in his State.

In 1935, a second report was sent to us from Australia giving the news that they had succeeded in getting the parasite to carry over through the winter in the field and that it had established itself in several areas where it was liberated. The report also adds that « we are looking forward to the time when it will at least bring this very destructive pest below the danger line ».

BIOLOGY OF THE IMMATURE FORMS

For developmental studies of the early stages of the parasite several rafts of *Nezara* parasite-free eggs were submitted for the adults in petri dishes for 24 hours. Dissectioning was carried out at several hours intervals. Physiologic salt solution was found as an important medium in preventing coagulation of egg contents, thus facilitating the separation of the stages desired.

Eggs

The egg is pearly white in color and in general pear-like in shape. When first laid it is roughly ovoid in form (Plate X, fig. 19). There is a distinct slender pedicel at one extremity. In freshly laid eggs, the stalk or pedicel is nearly as long as the egg ; but about 2/3 the length in eggs ready to hatch (Plate X, fig. 22). The egg measures on the average 1/4 mm. long and 1/7 mm. wide. The chorion of the ovarian egg is somewhat contracted here and there giving a slightly wrinkled appearance (Plate X, fig. 20). Eggs ready to hatch are almost twice as wide as fresh eggs and about 1/5 longer. Ovarian eggs after five minutes in physiologic salt solution become distended and their edge rounded (Plate X, fig. 21). After 24 hours incubation, the egg (as seen in Plate X, fig. 22) has grown considerably is size and is seen to be in a distinct blastoderm stage.

The contents are divided into two portions, a principal or germ center portion containing the viteline matter of the egg, surrounded by a single blastoderm layer and a paranuclear mass composed of a group of cells probably derived from the polar bodies.

First Stage Larva

This rat-like larva is as may be expected among the Proctotrupids a « Cyclopean » form (Plate X, fig. 23). It is composed of a large anterior portion which is the head and thorax (Plate X, fig. 24) fused together to form what is termed the cephalothorax among the Acarina, separated by a constriction from the posterior or abdominal portion. The head bears a pair of long comma-shaped mandibles which are very strong, pointed at tips and wide at base (Plate X, fig. 25). They are parallel to each other, closely set

aside and separated by a narrow cleft. They operate in a plane almost longitudinal to the body axis.

Ventrally, there is a large tubercle at a point near where the tips of the mandibles touch the exterior surface. The tubercle seems to have a duct-like orifice; this may be the salivary gland opening, consequently it determines the position of the labium.

The posterior or abdominal portion of the body which is round and sac-like in form is about twice as great in volume as the anterior portion. It bears dorso-laterally and at the anterior border of the first abdominal segment two rows of bristles unequal in length. These spines are long, slender and brownish in color. They move up and down with the peristaltic movement of the larva.

There is latero-dorsally, a long, slender and curved caudal appendage, the tail, which varies in length from 1/3 to 1/2 that of the body. A fairly long and curved anal process which bears fine spines at its end, is also located at the same plane.

This first larva which is 24 hours old measures about 1/5 mm. in length excluding the tail appendage. The mouth is a very small opening near the base of the mandibles and surrounded by a chitinized area.

There is a very thin light membrane which envelopes the embryo within the egg in the first and second stages, whereas it disappears in the third stage larva.

As larval development proceeds and after nearly 36 hours from hatching, there appears a secondary phase of the first stage. In this phase, which begins prior to moulting to the second stage (Plate X, fig. 26) the larva increases enormously in size, the constriction separating the anterior from the posterior portion becomes less pronounced and the caudal and anal processes assume a position apparently about mid-way of the abdomen ventrally, due to the enormous distension of the latter. The stomach is, however, still mostly withheld by the constriction in the posterior portion of the body.

Second Stage Larva

After about 48 hours feeding, the skin splits apparently dorsally and anteriorly and begins to slip off backwards and ventrally, thus producing the second stage larva (Plate XI, fig. 27). In the illustration the mandibles of the first stage are seen hanging on only by the loose skin attachments, and the row of setae are seen to be migrating ventrally.

The real second stage larva as revealed in the figure is roughly oval or oblong oval in shape. The body, although not distinctly segmented, shows the beginning of segmentation (one thoracic and nine abdominal). Only rudimentary swellings representing the mandibles are borne on the head which is flat and narrow. The head together with the thorax compute one-

third the length of the body. There are no visible spiracles, nor are there any body spines or setae. The body bears few hairs scattered on both sides as found in the first stage.

The stomach with its contents fill out the entire body cavity. The brain and central nerve cord are easily seen in this stage as shown in the illustration.

Full Grown Larva

The third stage or mature larva (Plate XI, fig. 28) is almost identical in shape with the second stage. It is not distinctly segmented, but the segments can be more or less accurately determined by the spiracular branches. It has a distinctly delineated head, a labrum, a pair of small sharp mandibles, rather widely separated, rudimentary maxillae and labium without distinct sensorial organs (Plate XI, fig. 29).

The respiratory system (Plate XI, fig. 30) is composed of two lateral tracheal trunks which are very conspicuous. There are also nine spiracular branches, with only two pairs of open spiracles anteriorly; the other seven being apparently functionless. There is a band of small tubercles ventrolaterally beginning from about the third thoracic segment to the caudal end of the larva where they unite ventrally.

Pupa

As the parasite transformation proceeds, two lateral light pinkish spots begin to show through the transparent egg cap (Plate VII, fig. 7). These spots represent the eyes of the pupa which is transparent white in color with the exception of the head and pronotum which appear dark brown.

When development continues the pupa looks darker (Plate VII, fig. 8). This is due to the color of the pupal cover, which is a very light and tender membrane enveloping the pupa within the host egg. Shortly afterwards the pupa turns entirely black and as the parasite matures it chews its way through a small irregular hole on one side of the egg cap and then with the aid of the head it forces its body finally out of the egg (Plate VII, fig. 9). The adult when it emerges is quite dry and in few seconds it moves about in a lively manner.

In the pupal stage the egg cap is easily removed and the chorion becomes brittle. There is always a surplus of food which exceeds the requirement of the developing larvae and which remains compressed at one side of the egg after the parasite emerges.

BIONOMICS AND LIFE HISTORY STUDIES

Mating

Mating takes place immediately after emergence at the first occasion when the two sexes meet. The operation lasts from five to ten seconds. The process is similar to that in other Proctotrupid species. One single male is capable of mating with several females in confinement.

Oviposition

An already mated female begins to lay her eggs directly after the host eggs are subjected for oviposition. The female parasite does not confine herself to one particular mass, but she is often seen to move from one egg to another in the same mass or in a different egg raft. That the parasite avoids depositing in an egg already parasitised does not hold true. Thus the sense of discrimination, although noticed among some individuals, does not constrain the promiscuous instinct of oviposition.

A virgin female laying for the first time takes about eight to ten minutes to lay her first egg and from three to five minutes to lay the second. In depositing her eggs, the female thrusts her ovipositor in the side of the egg near the top or bottom; she was never seen to lay at the top.

Two females were seen quietly engaged simultaneously in laying in one egg. The second started two minutes after the first has begun. After the first egg has been deposited, the parasite moves on to the next and repeats the process. This continues until the entire mass is parasitized.

For convenience in the study of oviposition, eggs were introduced to the adult parasites in ordinary Petri dishes. Each dish should be supplied with a wet cotton ball to furnish humidity. Food was offered as droplets of honey on oleander leaves.

Longevity and Prolificacy

Microphanurus megacephalus is considered a very prolific parasite. The females are able to lay all their life in confinement provided that they are supplied with the proper food and the required water for humidity.

Adult parasites are easy to handle under cage conditions. Females in the spring and fall were kept alive in cages for nearly three months. In summer, however, the breeding cages which are made of light muslin material to afford good ventilation, should be sprinkled periodically with water from the outside. This process resulted in the prolongation of the life of the adults and about 80 % lived for about 78 days and the last one died after 93 days in spite of an average temperature of 31° C.

With such longevity, one can readily postulate that the amount of eggs deposited by one individual female during her life is very great. But, it was found that females continuously forced to lay eggs live shorter life and the number of eggs diminish each time, until they lay no more. It was also noticed that females in the first three days of oviposition lay the greater number of their eggs after which the number drops suddenly, thus amounting to but few single eggs before they expire.

In spite of the fact that several parasite eggs can often be found in one *Nezara* egg, and even as many as six are not uncommon, the actual counts of the eggs deposited by one female were based on the number of host eggs actually parasitized, and on the bases of each egg issuing a single parasite.

The average number of eggs therefore, deposited by females cropped continuously varies with the season and is directly affected by the temperature and humidity prevailing. When Petri dishes were used as oviposition cages containing sugar cubes as food but no humidity was allowed during September. October and November, at which time the mean degrees of temperature and humidity of the breeding room corresponded to 25° C. and 64 % respectively, the average number of eggs for 24 hours per female rose to 116 and the minimum went down to 80. Longevity of the confined female extended to six days.

In April, May, June and July, i.e., at the advent of hot and dry weather, the number of eggs fluctuates between 50 to 60 per female, at a mean temperature of 26.5° C. and a relative humidity of 57 %. The average life of the confined female during this period is approximately four days. It is, therefore, the lack of proper ventilation and humidity in the dishes which shortens their lives.

When muslin cages or large glass chimneys were used to replace the dishes, and humidity was provided by continuous moistening of the cloth by an atomiser, the life of the parasites was multiplied five and sometimes seven times; and when the females were not cropped continuously but left to renew their energy from two to four days after every exposure to egg laying the total number of eggs was doubled and longevity was longer and in this case some of the parasites lived for nearly three months.

As previously stated, it was noticed during these experiments on oviposition that the greater number of eggs are laid in the first two days and then it drops suddenly especially from the third time of exposure upwards.

Males are noted to be very short-lived; they emerge first and die first. The maximum life of a male parasite does not generally exceed sixteen days, but on the average the life of the male varies from three to five days.

Longevity of the parasite is, therefore, inversely proportional with temperature within certain degrees. Food and humidity also affect longevity. Parasites deprived of food and water died after four days.

Sex Ratio

The ratio of males to female parasites is approximately 1:4, but this ratio has been subject to alteration through freezing the eggs as will be indicated later.

Life Cycle

The life cycle of the parasite from egg to adult varies with the season. This seasonal variation is the result of differences in temperature and humidity as seen from the following Table which represents the summation of figures taken during the last three years.

The Life Cycle of the Parasite

MONTH	MEAN TEMPERATURE	MEAN HUMIDITY %	NUMBER OF DAYS IN LIFE CYCLE	REMARKS
April	25.5°C	54	13	a. After 3-5 days, the host eggs show parasitism by changing in color.
May	26.5°C	55	11	b. From 5-7 days, the pupa begins to show through the egg cap.
June	28.5°C	57	10	c. The first larval stage is much longer in development than the second or third.
July	29.5°C	59	9	d. The third larval stage about twice as long as the second.
August	28.0°C	60	10	e. After 7-9 days, the color of the parasitized eggs turn black.
September ..	25.5°C	69	12	f. An egg raft requires from 4-10 days to issue all its parasites.
October	28.0°C	65	10	
November ..	22.0°C	58	18	

Egg Parasitization

Nezara eggs freshly laid are light orange in color but after exposure to to the parasite they change color into greyish, brownish and then blackish.

Host eggs with advanced embryonic development were exposed to the parasite for oviposition. They were fully accepted and issued healthy parasites.

Egg rafts stored in ice box for some time until their caps collapsed, failed to show any embryonic development after being taken out of cold storage; but when offered for parasitization about 95% developped and produced strong individual parasites of both sexes.

Super-Parasitism

It has been previously mentioned that a single host egg may contain as many as six first stage larvae. But in all these cases of super-parasitism only one parasite larva develops to the second stage. In the struggle for the survival of the fittest, the stronger larva with its formidable sickle-like mandibles is seen to puncture the skin of its competitors and sucks the visceral liquid contents leaving the rest to disintigrate as a result of phagocytosis.

Artificial Over-wintering

The most critical period for breeding the parasite is in winter from December till March. This period coincides with the hibernation of the bugs and the disappearance of host eggs. In order to ensure the carrying over of the parasites safely through the winter, a technique was devised which envolves the storage of a large supply of unparasitized host's eggs at 4° C. towards the end of the breeding season.

A plan was also adopted by means of which the life cycle of the parasite could be prolonged, i.e. by storing the parasitized eggs, after the first five days of development, into an ice chest at from 10-12° C. Eggs were offered for parasitization only once a week. Adult parasites should always be kept in a cool place at a temperature of 15° C, but when brought for breeding purposes they were gradually transferred to a temperature of 23° C.

With such a plan, it was not so difficult to get over the critical breeding period with some adults to ensure a large stock when host egg supply were most available.

TOLERANCE OF NEZARA EGGS AND ITS PARASITE TO COLD STORAGE

Nezara eggs, due to their heavy chorion, can stand preservation in cold storage for an appreciable length of time with practically little damage. Egg embryos in this case apparently cease development or rather their development becomes too slow to be noticed. In spite of the long period of preservation the eggs, however, prove to be still favorable for parasitization and the development of the immature forms of the parasite.

The request from the Government of Western Australia for a shipment of the parasite enthused the writer to carry a series of experiments on the optimum temperature for preserving the host eggs as well as the adult parasites. Tests, therefore, were conducted on the degree of tolerance of the host eggs to freezing without deterioration and the maximum period after which they become unfit for parasitization. Unparasitized eggs stored in a Frigidaire at 6-8° C remained good for parasitization after 47 days. After 55 days, the egg caps collapsed and the contents became unsuitable for the development of the parasite.

Eggs three to five days after being exposed to oviposition were found to stand the journey safely provided that they were placed in the vegetable compartment of the steamer at a temperature from 8-10° C.

This resulted fortunately in synchronising the emergence of adults with approximately the date of arrival. Thus, we succeeded in getting some adults reaching their destination safely.

The following Table shows the degree of tolerance of parasitized eggs to cold storage.

MONTH	NUMBER OF DAYS BEFORE COOLING	NUMBER OF DAYS IN COLD STORAGE	DEGREE OF COOLING	LIFE CYCLE	RESULTS AS INDICATED BY EMERGENCE
June	5 days	6	8-10°C	21	Good.
July	3 days	7	8-10°C	21	Good.
August	5 days	10	8-10°C	22	Good.
September	7 days	12	8-10°C	27	Good.
October	4 days	15	8-10°C	31	Fairly good
November	8 days	20	8-10°C	33	Bad.

When the unparasitized *Nezara* eggs were placed at a temperature of 7° C for 6 days, they failed to hatch. The same eggs preserved their appearance well for nearly a month after which 83% of them collapsed suddenly. These last eggs, however, were accepted for parasitization exposed to the adult parasites and issued healthy individuals.

Sex and Cold Storage

It was quite interesting to note on computing the sex ratio of the parasites emerging from the eggs which were kept in the Frigidaire for over a month (about 47 days) that males were more preponderous than females, and that a high mortality among the adults occurred during emergence and a short time after it. Results of an egg mass composed of 68 eggs kept for 48 days at a temperature of 70° C. are as follows :

18 died through emergence.
3 died as adults within the eggs.
23 emerged (10 females and 13 males).
24 eggs failed to develop any parasites although they were parasitized.

Adult *Microphanurus* reared in small vials 3 × 9 cms. are known to be susceptible to low temperatures. For instance, at 40° C, they lived only for 6-8 days. When they were placed at 70° C, just at the time when they started to emerge from the eggs, they were kept alive from 10 to 12 days. Whereas, at 10° C, the adult parasites survived for 12-17 days.

Tolerance of the Immature Forms

Tests on the degree of endurance of the immature forms of the parasite to cooling were also done and it was found out that the 2nd larval stage is more tolerant than the others. Parasitized eggs cooled before their larval development reached the second stage, or has already developped to the last or third, produce generally a very high rate of mortality. It was also noticed that quite a number of adults die in attempting to issue from the eggs.

Other Hosts

Eggs of other Pentatomid bugs such as *Carpocoris pudicus* (Poda) are found to be parasitized in the laboratory by the *Microphanurus*, however, parasitized eggs of this bug have not been collected from the field.

Colonization of the Parasite

Our experience in Egypt indicates that field liberation of this parasite in new localities should be delayed until June in order to ensure an abundant supply of host eggs. Parasites should be liberated only once a week and concentrated at points where scouting definitely manifests that the egg deposition period has already commenced so that the parasite and the host egg supply would reach their peak about the same time.

This parasite is so efficient in its work that once a colony is established, it is not necessary to reinforce it by continuous liberation. The parasite in itself, is capable of spreading rapidly and eventually destroys a good percentage of the pest. The selection of additional localities for further colonization is much more important than reinforcing the old ones, especially during the season when the host egg supply in the field is adequate enough to ensure continuous production of the parasite.

Word had been received in 1935 from the Government Entomologist of Western Australia that they were very gald to succeed in getting the parasite established in several areas in the State. He concludes by saying « we are looking forward to the time when it will at least bring this very destructive pest, *Nezara viridula*, below the danger line ».

Economic Importance

Since the *Nezara* is not a pest in Egypt due to the high percentage of parasitism in the egg clusters by the parasite *Microphanurus megacephalus*, it is, therefore, quite evident should this very active and efficient parasite be transferred to countries where the bug has become a permanent menace to agriculture that its economic importance will be greatly manifested.

For this reason, it is our expressed hope and desire that the parasite will prove its value in its new territory, Western Australia, as soon as its reproduction reaches a population somewhat parallel to the peak of abundance of the destructive bugs.

As is the case with every parasitic insect, the peaks of abundance of both host and natural enemy should occur in cycles with the natural enemy always a little in the rear, otherwise the parasite will be headed towards extinction for the lack of food material.

Conclusion

Nothing better can satisfy the desire and fond hope of an entomologist than to see the achievement and realization of his efforts and accordingly reap the fruits of his endeavors.

Enthusiasts of the method of biological control always cite with pride the matchless success of the *Vidalia cardinalis* (lady-bird beetle) in subduing the ravages of the cottony cushion scale.

Another example of similar efficiency in the field of biological control is always sought in the accomplishment of the egg parasite *Microphanurus megacephalus* in combating an active pest of measurable importance.

This success is manifested in the following letter dated July 8, 1937 by L. Newman, Entomologist of the Government of Western Australia, in which he states that the introduction of the parasite « is certainly to be counted as one of our successful biological efforts, and to you (referring to our entomological section) we are greatly indebted..... In several areas the parasite is now well established and has restored the balance of nature ».

He further declares that « This Green Bug was a pest of major importance as it attacked all kinds of plants. Tomatoes, beans, potatoes, cabbages, beetroot, rhubarb and other vegetables were seriously damaged. Pears, oranges, stone fruits and grapes were also attacked, spoiling their market value and causing them to quickly rot. Many garden flowers such as hollyhocks, amaranthus, dahlias and other succulent plants were ruined. Maize was also a much sought after host plant. The parasite has now carried through three winters and is readily picked up again in the spring..... It certainly has cut down the loss, not so much by reducing the use of insecticides which were not used much against this bug on account of the difficulty of success-

fully combating this pest by that means, but by the saving of the market value of the produce. Bug affected fruits or vegetables were not marketable on account of the discoloration caused by the bugs and the fact that they would not store or keep ».

Explanation of Plate VII

Fig. 1. — Cotton Green Bug, *Nezara viridula* L.

Fig. 2. — Fresh Cotton Green Bug egg, side view.

Fig. 3. — Fresh Cotton Green Bug egg, top view.

Fig. 4. — Empty *Nezara* eggs which have been sucked by the adult bug; feeding tubes quite visible.

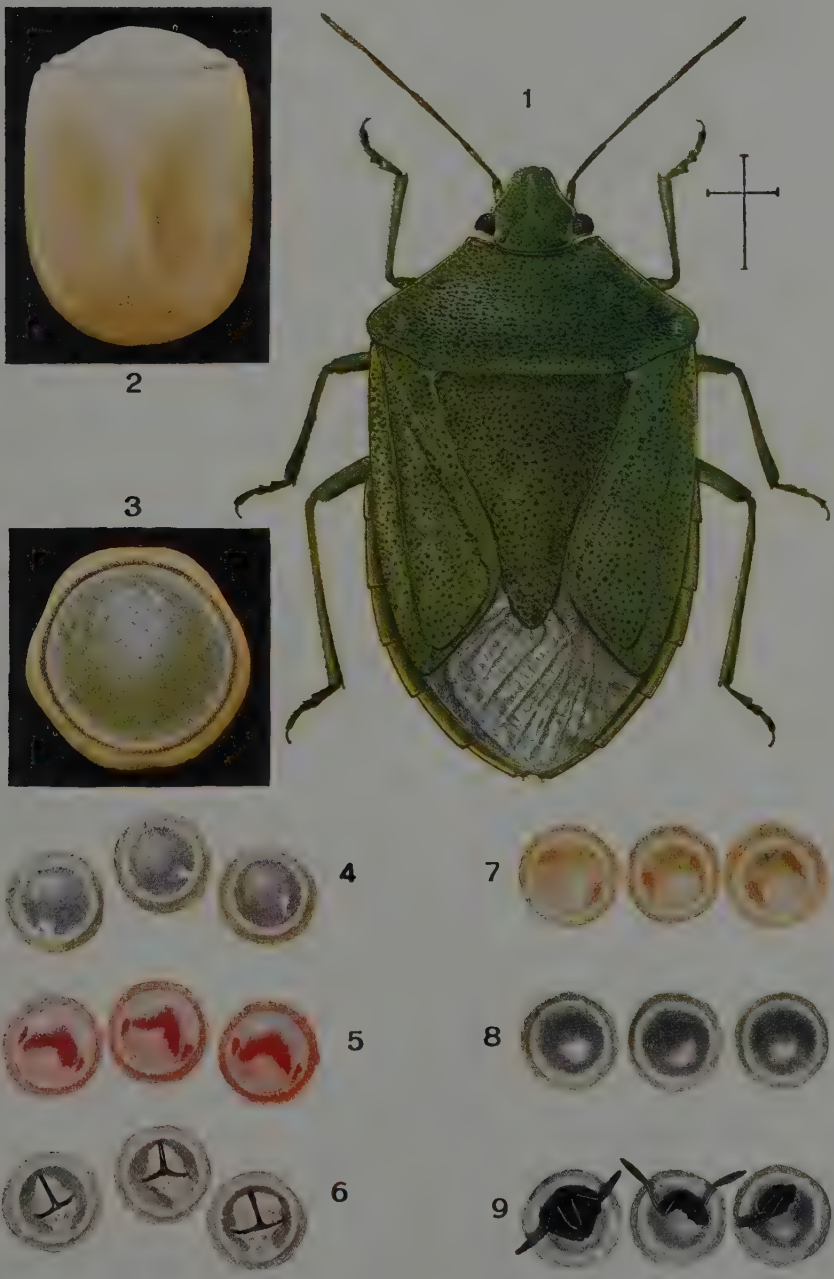
Fig. 5. — *Nezara* eggs before the nymphs hatch out.

Fig. 6. — *Nezara* eggs that hatched into nymphs.

Fig. 7. — Eye spots of the pupa of *Microphanurus megacephalus* (Ashmead) visible through the *Nezara* egg cap.

Fig. 8. — The parasite (*Microphanurus megacephalus* (Ashmead)) within the egg and prior to emergence.

Fig. 9. — The parasite (*Microphanurus megacephalus* (Ashmead)) chewing its way through the host's egg cap.



The Cotton Green Bug (*Nezara viridula* L.) and eggs.

PLATE VIII

Explanation of Plate VIII

Fig. 10. — Newly hatched or gregareous form of the *Nezara viridula* L.

Fig. 11. — First stage nymph of the *Nezara viridula* L. after 24 hours.

Fig. 12. — First stage of the *Nezara viridula* L. at its final nymphal development.

Fig. 13. — Second nymphal stage of the *Nezara viridula* L.

Fig. 14. — Third nymphal stage of the *Nezara viridula* L.

Fig. 15. — Fourth nymphal stage of the *Nezara viridula* L.

Fig. 16. — Fifth nymphal stage of the *Nezara viridula* L.

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The Cotton Green Bug (*Nezara viridula* L.) : nymphal stages.

PLATES IX-XI

Explanation of Plate IX

Fig. 17. — An egg mass of *Nezara viridula* L. just hatched showing the aggregation of the young nymphs.

Fig. 18. — Various sizes and shapes of the egg masses of the Cotton Green Bug, *Nezara viridula* L.

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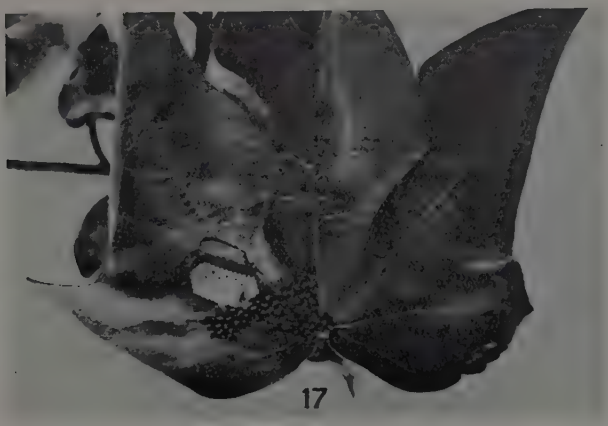
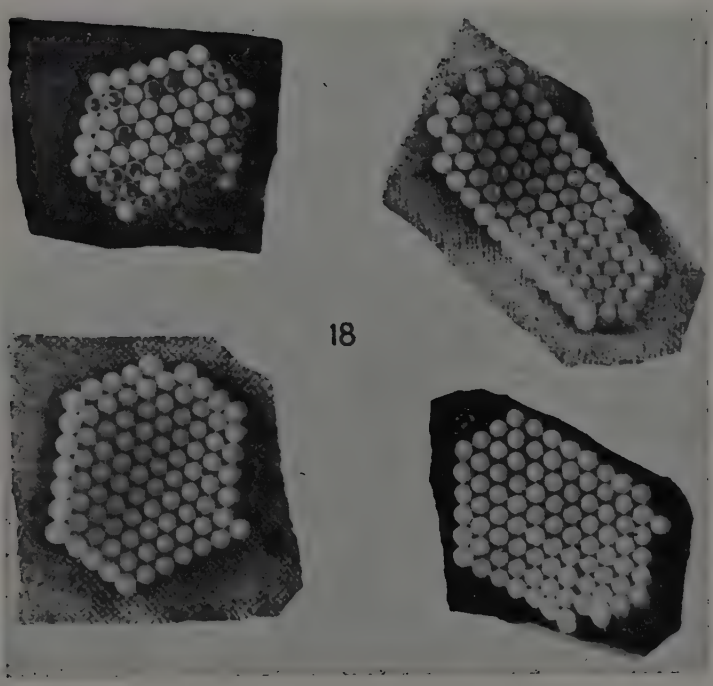
Plate IX





The Cotton Green Bug (*Nezara viridula* L.) : egg masses.

Explanation of Plate X

Fig. 19. — Newly laid parasite egg *(Microphanurus megacephalus)* extracted from the host egg (*Nezara viridula*).

Fig. 20. — Another parasite egg also extracted from the host egg.

Fig. 21. — The parasite egg after a stay of 5 minutes in physiologic salt solution.

Fig. 22. — The parasite egg after 36 hours.
V = viteline material; B = blastoderm; P = paranuclei.

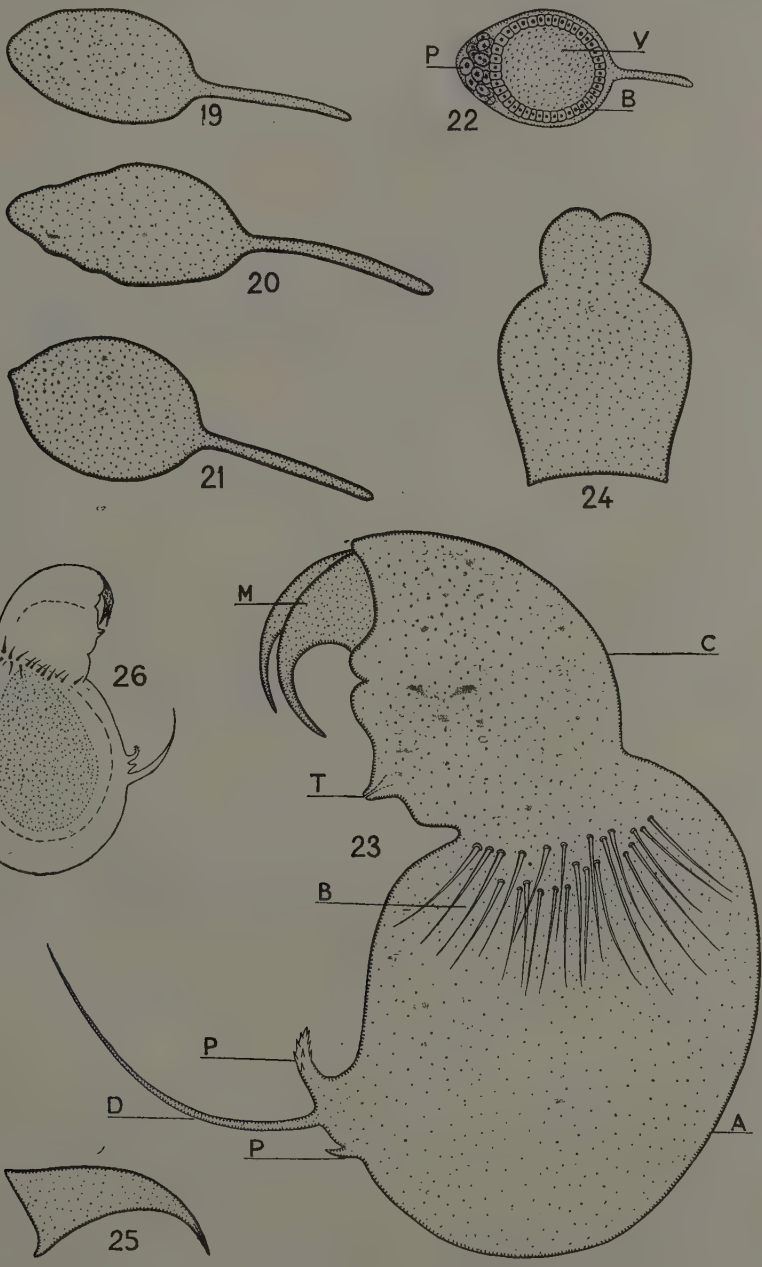
Fig. 23. — Side view of the first stage parasite larva (24 hours).
A = abdomen; B = bristles; C = cephalothorax; D = caudal appendage; M = mandibles shown to work in a longitudinal instead of transversal plane; P = anal process; T = tubercle with duct-like opening.

Fig. 24. — Head and thorax of first stage parasite larva, dorsal view.

Fig. 25. — Mandible of first stage parasite larva.

Fig. 26. — First stage parasite larva after feeding and prior to moulting, showing also spines on the line separating segments of third thoracic and first abdominal.

Dr. M. Kamal Plate X



The egg and first stage larva of *Microphanurus megacephalus* (Ashmead).

Explanation of Plate XI

Fig. 27. — Second stage larva of the *Nezara* egg parasite with stomach contents filling entire body; first stage mandibles hanging by bits of skin to second stage mandibular rudiments; anal processus still clinging on, too; the hair position shows that first stage skin has split on back of thorax.

S = stomach; B = brain; N.V. = nerve cord; M = mandible.

Fig. 28. — Sub-lateral view of the third or last larval stage. The amorphous larva carries tubercles posteriorly and ventrally, the latter being placed laterally on each side.

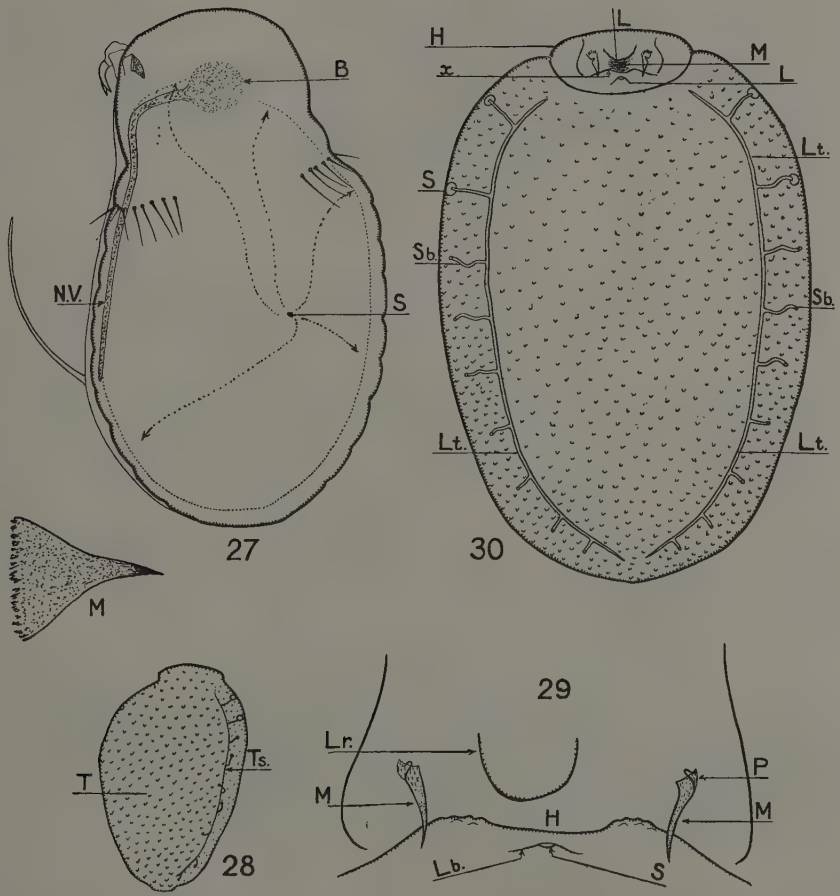
T = body tubercle; Ts = tracheal system showing opened and closed spiracles.

Fig. 29. — Details of mouth-parts of last larval stage.

Lr. = labrum; P = remain of pleurostoma; M = mandible; H = mouth opening; Lb. = labium; S = salivary duct opening.

Fig. 30. — Ventral view of last stage larva of the *Nezara* egg parasite showing spiracular system.

H = head; L = labrum; M = mouth; Lb. = labium; X = maxilla; Lt. = lateral trunk; S = open spiracle; Sb. = spiracular branch with closed spiracle.



Microphanurus megacephalus (Ashmead) : second and third larval stages.

Séance du 24 Novembre 1937

Présidence de Monsieur le Prof. H.C. Efflatoun Bey, *Vice-Président.*

Contributions towards a knowledge of the Thysanoptera of Egypt, XI

(with 10 Illustrations)

by Prof. Dr. H. Priesner.

30. CHIEFLY ABOUT UNRECORDED SPECIES

Aeolothrips collaris Priesner.

Uncommon, in flowers of *Medicago sativa*, *Vitex agnus-castus* and *Poinciana regia*, from April to June, in gardens but also in the desert valleys. — Cairo, Helouan. — Known from Europe, Canary Islands and Asia Minor.

Rhipidothrips gratiosus Uzel.

In the North only. Mersa Matruh, Wadi Umm-el-Rakham, III.1933, swept from tall grasses.

Anaphothrips obscurus (Müll.).

A macropterous female was given to me by Mr. Willcocks who took it on 4.V.23 from cats-tail grass (*Polypogon monspeliensis*); another specimen I found in turf material from Cairo. This species, widely distributed over the palaearctic and nearctic regions, is not at all common in Egypt and certainly local in its habitat. Very likely introduced from Europe.

Aptinothrips rufus (Gmel.).

On my first visit to Mersa Matruh, in March 1933, I swept a few specimens of an *Aptinothrips* in the Wadi Umm-el-Rakham, from grasses, together with *Rhipidothrips gratiosus;* these specimens were lost; another two females I sieved from «negeel» (*Cynodon dactylon*) when examining the same locality, on 28.III.35. This species seems only to exist in the most humid parts of the country. The specimens are in no way different from the European ones. In Europe, this species is a pest of meadow grasses.

Retithrips syriacus (Mayet)

I am mentioning here this common vine thrips particularly in order to verify Krygers statement (Bull. Soc. Roy. Ent. d'Egypte, XVI, 1932, p. 40) that its eggs are parasitized by a Chalcidid (*Sethosiella priesneri* Kryg.); I never had any doubt on the fact that the *Retithrips* is the host of the *Sethosiella;* but sections through leaves containing parasitized eggs were made (by Dr. Tewfik Fahmy), which contained the parasite; the same parasite was reared and submitted to me for comparison, by Dr. E. Rivnay of Rehoboth, Palestine. — Parasites of the larvae or pupae, as they are known from East Africa, have not been observed in Egypt.

Heliothrips haemorrhoidalis (Bouché).

Climatic reasons are responsible for the scarcity of this insect in Egypt (cf. Rivnay, Bull. Soc. Roy. Ent. d'Egypte, XIX, 1935, pp. 119-124). — Females and larvae, 4.VIII.20, on leaves of grape vine and peach (leg. W.J. Hall?), in coll. Min. Agric.; in summer 1932, one female, in a garden in Alexandria, on leaf of *Acalypha* (leg. H. Priesner); many larvae and females, in glass house, 25.V.34, Alexandria, on *Croton* and *Camellia* (leg. Dr. Moh. Kamal).

Limothrips angulicornis Jablonowski.

In the North only. — ♂♂ and ♀♀, Mersa Matruh, in Wadi Garaula and Wadi Umm-el-Rakham, III.33, on barley and wild grasses.

Microcephalothrips abdominalis (Crawford).

M. microcephalus, described by me from Egypt in 1923 (Ent. Mitt. XII, pp. 116-117), is not specifically different from the American or Malaysian forms. The synonymy of this almost cosmopolitan species is included in St. F. Bailey's notes on this species (Canad. Ent., LXIX, 1937, pp. 121-122. It is not very common in Egypt but occurs practically all the year round, and was collected from the following flowers : *Ageratum conyzoides*, *Erigeron crispus*, *Pulicaria crispa*, *Chrysanthemum* spec. (cultivated), *Chenopodium* spec.

Odontothrips karnyi Priesner.

In February and March, common all over the country, from Shellal to Alexandria, common also in Sinai. In the collection of the Ministry of Agriculture, there are specimens of the insect from the year 1914 (on *Lathyrus odoratus*). The larva is very likely confined to the family *Leguminosae* but the adult, when it numerously appears in spring, may be collected from flowers or leaves of other plants, as e.g. *Papaver rhoeas*, *Chenopodium*,

Calendula, Citrus (leaves). Host plants are : *Lupinus* sp., *Lathyrus odoratus*, *Medicago hispida*, *Retama raetam*.

Karny's record on *Taeniothrips sjöstedti* (Denkschr. Akad. Wiss. Wien, math-nat. Kl., 98., 1922, p. 117) belongs to this species (*O. karnyi*), as it appears from the specimens in Karny's collection.

Prosopothrips nigriceps Bagnall.

A few specimens (females) I collected on 24.III.33, near Salloum, on grasses growing on the sand dunes near the sea shore. Hitherto known from the south of France only.

Stenothrips graminum Uzel.

Females, Mersa Matruh, III.33, from *Gramineae*.

Taeniothrips dianthi Priesner.

Occasionally found as a pest on carnations, in gardens of Cairo. The first specimens I saw from Egypt were collected by Mr. F. C. Willcocks (in Gezira), on 4.V.29. The eggs are laid in the calyx-leaves, the larvae feed on practically any arial part of the plant, the adults are on the leaves or in the flowers. Plants growing on unsuitable soil may be badly attacked. Known from Europe and Morocco (leg. Rungs).

Taeniothrips discolor (Karny).

Together with its f. *lythri* Ka., in the Nile valley as well as in the desert, on various flowers. Localities : Cairo (Mataria), Giza, Helouan, Wadi 'Of, Alexandria, Salloum. Hosts : *Calendula* sp., *Iphiona mucronata*, *Odontospermum graveolens*, *Crozophora tinctoria*, *Artemisia* sp., *Linaria aegyptiaca*, *Limoniastrum monopetalum*, *Parkinsonia aculeata*. From I to VI. — Known from South Europe and Cyprus.

Taeniothrips haegardhi (Trybom).

Identical with *Taen. niloticus* Priesner, as the type specimens show. — The original host plant of this insect is *Acacia;* in Egypt, *A. arabica* var. *nilotica* and probably other *Acacia* spp. ; the thrips is common in the flowers, and also occurring in those of the following plants : *Caesalpinia saepiaria*, *Pulicaria crispa*, *Punica granatum*, and with larvae on grasses, as *Triticum* (wheat), *Polypogon monspeliensis*, *Zea mays* and the *Cyperaceae* : *Scirpus badius*. — Known to me from Sudan, Egypt and India.

Thrips mareoticus (Priesner).

This species, described as *Stenothrips* (owing to the sometimes 2-jointed

maxillary palpi) is better placed in the genus *Thrips;* Speyer's *Thrips tenuisetosus* (Bull. Soc. Sci. Nat. Maroc, XV, 1935, p. 5) and Hood's *Thrips quadrisetosus* (Bull. Soc. Roy. Ent. d'Egypte, 1932, p. 124, Pl. IV, figs. 1-5) are identical with *marcoticus*. It seems to occur in the *north* of Egypt only, was collected from III to V and again in IX, from flowers of *Achillea santolina*, *Reichardia tingitana*, *Chrysanthemum coronarium*, all belonging to the family *Compositae*. — It is a Mediterranean element and is known to me from Morocco, Egypt, Cyprus and Palestine.

Thrips angusticeps Uzel.

A common species but hitherto only collected on the northern costal area, and in Sinai. It was found from III to IV, and again in September, occuring in flowers of *Convolvulus althaeoides*, *Chrysanthemum coronarium*, *Reichardia tingitana*, *Cistanche lutea* and on *Hordeum* (barley).

Thrips tabaci Lindeman.

In Egypt the most serious pest of the hole order, having a wide range of host plants, and attacking the young cotton plant in spring. Special papers on this insect will be issued by the Ministry of Agriculture. *Thrips tabaci* was well known to F.C. Willcocks but not identified at the time of publication of his « Survey » ; the following of Willcocks' notes refer to this species : Survey I, 1922, pp. 29, 48, 57, 116, 117, 132, 140, 147, 298, 340 and 356 ; Survey II, 1925, pp. 82, No. 3 ; 413. A special chapter is devoted to this species by Willcocks in his recent work on the insects of the Cotton Plant (1). — Shafik and Hosny (Bull. Min. Agric., Techn. Ser. 166, 1936, p. 4) mention *Thrips tabaci* as damaging *Pyrethrum* flowers in the Entomological Section's farm at Dokki.

Thrips nigropilosus Uzel.

In spring 1936, this insect has appeared in the Entomological Sections farm at Dokki, as a pest of *Pyrethrum cinerariaefolium*, severely attacking the leaves. I had discovered it in 1931 (2.VI.) on the under side of the leaves of *Althaea* (hollyhock) in the Horticultural Farm at Giza. I consider it as an introduction from Europe.

Haplothrips clarisetis Priesner.

A common species, also in the Sinai peninsula. Very numerous with its early stages in the flowers of *Gynandropsis pentaphylla*, *Beta cicla*, and

(1) The insect related pests of Egypt, Vol. I, part 2, 1937.

Chenopodium sp. Adults also on *Kochia muricata*, *Vitex agnus-castus*, *Anabasis setifera*, *Aerva tomentosa*, *Juncus acutus* and *Artemisia herba-alba*. All the year round, in the Nile valley as well as in the desert. — Originally known from South Africa; recently recorded by me from Palestine.

Haplothrips reuteri (Karny)

Meadi, Suez Road, on *Haloxylon* and in flowers of *Retama raetam;* common in Sinai, II and V.1935, Wadi El-Areesh, Wadi Gederat and Wadi Isla, collected by A. Rabinovitch and W. Wittmer.

Haplothrips talpa Priesner.

Widely distributed but not common : Cairo (Kafr-Hakim, Wadi Umm-Assad), Sinai (Wadi El-Areesh), Dakhla Oasis (Gedida) and Gabal Aelba; I to V; on *Punicum turgidum* and in flowers of *Retama raetam*. — It was known to me from South Africa.

Leptothrips karnyi Trybom.

Originally known from the Sudan; Mr. Wittmer collected a specimen of this *Acacia*-insect in the Wadi Isla, Sinai. I also saw examples from the Sudan (Hag Abdulla and Tayiba), X and XI, from *Acacia nubica*, and cotton leaves (leg. W. P. L. Cameron, Nos. 113 and 93, respectively).

Liothrips reuteri (Bagnall).

Identical with *Liothrips dampfi* Karny. — Common all over Egypt on *Tamarix*.

Neoheegeria dalmatica Schmutz.

Sinai, Wadi Gederat, on *Juncus acutus*, 8.V.34 (H. Priesner); Wadi Gederat and Road Kuntilla-Kosseima, 25.V.35 (A. Rabinovitch). — This is supposed to be a Mediterranean element, originally known from Yugoslavia, recently collected in Palestine by Bodenheimer.

31. SOME NEW FORMS OF AEOLOTHRIPS.

Aeolothrips (Podaeolella) eremicola, spec. nov.

Female. — Reddish brown (to blackish brown) owing to the abundant crimson pigment of thorax and abdomen, red pigment cells also in 1st and 2nd antennal joints, a few only in the head; femora dark, fore tibiae and tarsi (the latter brown at tips) whitish yellow with base of tibiae shaded, the shaded portion reaching the middle of the tibia at its inner, surpassing it at its outer surface; middle and hind tibiae dark, the tips (1/6 to 1/5) abruptly

whitish yellow, as well as the tarsi, excepting their apices; tip of the abdomen darker than the remainder portion, which is pale reddish brown, the specimen obviously not being fully mature; antennae pale, whitish yellow — only joints 1 and 2 as dark as the head —, 3 slightly shaded about the apical 4th or somewhat more, 4 slightly and indistinctly shaded about apical half (or less), 5 to 9 pale grey but 5 paler about basal half; fore wings colourless with two narrow grey cross-bars which are united at the hind-marginal costa, the dark edge occupying the outer half of the space between the hind vein (which remains colourless) and the hind margin, thus more than the costa being shaded; the 1st cross-bar has the distal margin strongly oblique, the 2nd one having the proximal margin so, the latter with its distal margin strongly concave.

Front ocellus much smaller than hind ocelli; micro-setae on vertex rather irregularly placed, but there is 1 close pair near to, and in front of the 1st ocellus, and two pairs at its sides, 3-4 pairs (partly inconspicuous) more in the space between the ocelli and the eyes, and about 9 inconspicuous pairs on the vertex behind the ocelli and eyes. Antennae length about 380 μ; measurements of joints: 32(35-36), 54-56(27-28), 96(22), 76(22-23), 56-58(24), 66(24), 14(17), 14(15), 20(11), 11(5) μ; length of sensory area on joint 3: 28 μ, occupying about the distal third, that on joint 4 reaching the extreme tip of it, curved and broadened at apex but not quite attaining the middle of the joint, 40-45 μ long; joint 5 distinctly thicker than any one of the following joints, though somewhat shorter than 6-9 together; pronotum length about 155 μ, microsetae on disk much scattered; pterothorax width about 295 μ, the median pair of dark bristles on the mesoscutum 24-26, the hind angular pair 40 μ; wings length 830-850 μ; width across 1st anterior cross-vein 108-112 μ, across second cross-vein (beginning of 2nd cross-bar) 128-132 μ; the first cross-band occupies about 120-128 μ at fore margin, the second cross-band about 124-136 μ at the same margin; second cross-vein (at fore marginal costa) situated at the beginning of the second cross-bar; hind marginal fringe of fore wings dark; hind wings almost colourless; length of fore tibiae 172-180, of hind femora 284, of hind tibiae 252-256 μ; longest, terminal (greyish yellow) spines of hind tibiae 32-40 μ; no accessory bristles on the sternites 2-6; length of segment 9 (dorsally) 108, of segment 10: 90 μ; bristles on segment 9: 132-145, on segment 10: 128-140 μ.

Male: Unknown.

This species is the first Egyptian representative of the *Podaeolella* section of *Aeolothrips*; it certainly comes close to *similis* Priesner, which will have to be considered as a proper species, not a variety of *versicolor* Uz., after the discovery of the male —; not only the colour of the antennae which is quite different, but also that of the wings which are much broader too, easily distinguish the new species from *similis*; the head is distinctly produced in

front in both, *versicolor* and *similis* but only slightly rounded in *eremicola*; the latter character also applies to *Ae. titschacki* spec.nov. (Canary Islands) (2), which has long, narrow wings that show the same markings as in *similis*.

Habitat : Egypt (Wadi 'Of near Helouan), in spring 1937, on *Zilla spinosa* (in bloom).

Aeolothrips ghabni, spec. nov. (3)

(Figs. 1 and 3)

This common species I had confused hitherto with *Ae. deserticola* (Bull. Soc. Roy. Ent. d'Egypte, 1929, p. 61) ; in fact, the females of these two species

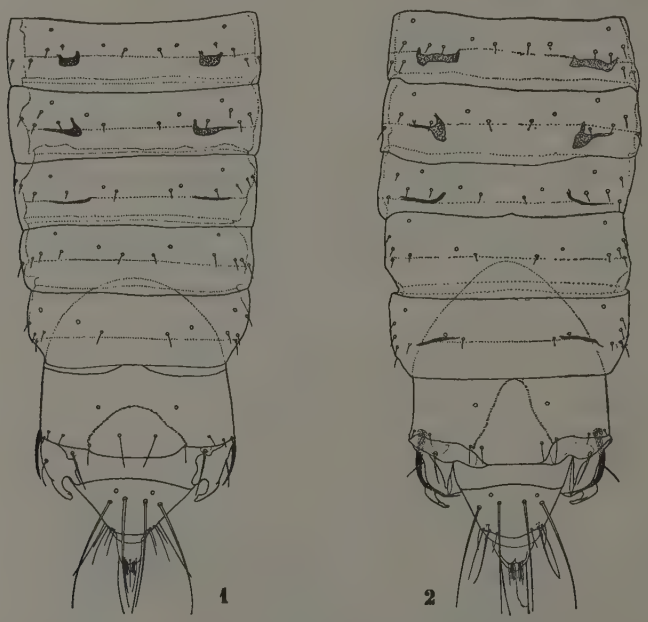


Fig. 1. — *Aeolothrips ghabni* spec. nov. : Abdominal segments 4-11 of male.
Fig. 2. — *Aeolothrips deserticola* Pr. : Abdominal segments 4-11 of male.

(2) *Aeolothrips titschacki* spec. nov. (= *versicolor* f. *similis* Priesner p.p.; Stett. Entom. Ztg., 1933, p. 184) differs from *similis* — with which it agrees in the colour of the wings — by its larger size, the head not being produced in front, and in having antennal joint 5 long (80 μ), much longer than 6-9 (56 μ) together. A more accurate description of this form will be given elsewhere.

(3) I have pleasure in dedicating this common species to my friend and collaborator, Dr. Abdel Aziz El Sayed Ghabn, in recognition of his valuable studies on thrips in Egypt.

are extremely similar to each other, and only the male characters are absolutely convincing as to their specific value.

Male : Antennal joint 5 about as long as, or little longer than, joints 6-9 together (as in female, fig. 3), in *deserticola*, joint 5 more convex and decidedly shorter than 6-9 together (as in female, fig. 4) ; chitinous plate-like appendices (fig. 1) of tergite 4 less broad, about twice as broad as long, in *descrticola* (fig. 2) 3 to 4 times as broad as long ; appendix on segment 5, not prolonged, not tooth-like, whilst it has the shape of a curved tooth in *deserticola ;* on tergite 6, the appendix is reduced to a slight thickening, about the same in both species ; on tergite 8, this vestigial appendix is present in *deserticola* but wanting in *ghabni ;* on tergite 9, the hind margin is somewhat less strongly protruding in the middle, in *ghabni* than in *deserticola ;* the more strongly chitinized, rather dark central portion of tergite 9 does not reach the base of this tergite in the new species, while it does, and is a high triangle in shape, in *deserticola ;* the two innermost bristles of tergite 9 are longer, and situated about the middle of the dark central portion, and somewhat closer to each other than to the second pair of bristles, whilst they are far from each other, close to the second pair of bristles, and smaller, in *deserticola ;* the strongly curved, dark, lateral spine of segment 9, as a rule, is stouter and longer in *deserticola* than in *ghabni*.

Female. — The antennae (cf. figs. 3 and 4), though similar in colouration to those of *deserticola*, are somewhat more slender, and particularly different in having *joint 5 longer*, more parallel-sided and not converging before apex, whilst in *deserticola*, joint 5 is slightly narrowed before tip and much shorter, particularly in comparison with joints 6-9 together, e.g. 5 : 6-9 = 66-78 : 80-92 μ in *deserticola*, 68-90 : 70-80 μ in *ghabni ;* joint 6 is always longer and has somewhat convex sides in *deserticola*, shorter and more parallel-sided in *ghabni*. The pronotum is finely but distinctly transversely striate in both species, wherein they differ from the bulk of the *fasciatus*-group. The position of the second cross-vein (between costa and upper vein) is somewhat irregular in both species, but in the majority of cases it begins with the second dark cross-bar, and is never deeply inside the latter, as long as it is not doubled, as in comparatively rather rare abnormal cases ; in *deserticola*, the second cross-vein lies even often somewhat within the white portion, before the beginning of the dark cross-bar.

In 1933 (Stett. Entom. Ztg., 94, p. 179), I recorded *Ae. deserticola* from the Canaries ; these specimens, however, collected in great numbers by Dr. E. Titschack, do not belong to the true *deserticola* but are very close to *ghabni*, though there are some slight differences which may be considered as racial characters. The antennae of the female of the form from the Canary Islands are about as in *ghabni* but joint 3 is somewhat lighter in most of the specimens ; also in the male, the arrangement of the appendices and

their shape is very similar to that of *ghabni*, except that the plate on tergite 5 is somewhat more distinctly triangular, the chitinized central portion of tergite 9 is a little more strongly produced towards base but not reaching it (as in *deserticola*), and the bristles in the middle of this dark, central part are longer than in *ghabni*; one may call this form : *Ae. ghabi* ssp. *insulanus* nov.

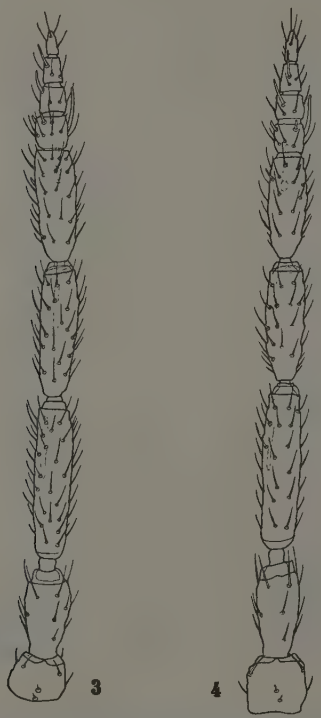


Fig. 3. — *Aeolothrips ghabni* spec. nov.: Antenna of female.
Fig. 4. — *Aeolothrips deserticola* Pr.: Antenna of female.

It is interesting to note that all our records of *Aeolothrips ghabni* pertain to examples collected in the northern costal area of Egypt (from Mersa Matruh to Alexandria), with one exception, i.e. a specimen from the Siwa Oasis; they were taken from II. till IX. from various flowers (*Convolvulus althaeoides*, *Ononis vaginalis*, *Chrysanthemum coronarium*; and by sweeping); it is a very common insect which must have more than one generation, as one meets even the male also in September.

Ae. deserticola, however, was not observed so far in the above mentioned

area but only in the desert valleys east of Cairo and in the Sinai peninsula; it is also common, always in the flowers of *Zilla spinosa* (*Cruciferae*), from II until IV; more rarely on other plants, as *Trigonella* sp.; my Sinai specimens originate from the Wadi El-Areesh (Road Areesh-Hassana), collected by Mr. A. Rabinovitch in March, and from the Mitla mountains where I saw thousands of specimens with larvae in the blue flowers of the Crucifere : *Diplotaxis acris*, in April 1937; this species might well be confined to the family *Cruciferae*.

32. ON THE SEXUAL DIMORPHISM IN MYCTEROTHRIPS TRYB.

Mycterothrips acaciae Priesner.
(Bull. Soc. Roy. Ent. d'Egypte, 1932, p. 5)

(figs. 5 and 6)

Male (ined.). — Pale yellow with the thorax pale orange; legs and wings shaded with very pale grey; joint 1 of the antennae whitish, joints 2 to 7 more or less dark grey, 2 to 5 paler at base; ocelli red; bristles dark.

Antennae 7-jointed, joint 5 short, broad at apex, 6 long (fig. 5), parallel-sided, constricted before tip, bristles well developed; measurements of joints (of allotype) : 17-20(22), 31(20), 39(15), 32-34(15), 27(17), 52-53(15-17), 14(6) μ; sense-cones on 3 and 4 forked; head width across eyes ab. 112 μ; lateral diameter of eyes 48; a few ommatidia larger than the others; post-ocular bristles *between* the hind ocelli, 36 μ long; cheeks straight, converging posteriorly; mouth-cone *moderately* long, head length (laterally) from front ocellus to tip of mouth-cone 180 μ, head length including rostrum 185 μ, tip of rostrum not surpassing base of prosternum; maxillary palpi, 13-14, 8, 14 μ; small hairs on pronotum and legs conspicuous, somewhat raised on the latter; those on the fore margin of the pronotum (4 pairs) directed forward; 13-15 pairs of discal bristles; postero-angulars 28-32 μ long; 2 pairs of smaller ones within; pronotum length 115, width 152 μ; pterothorax width 200 μ; basal bristles of metascutum 26-28 μ, practically at the fore margin; wings length 570 μ; costa with about 26, upper vein with 4(5)+3(4) basal and 2 distal bristles, lower vein with 11-13 bristles; tergite 2 with three lateral bristles, dorsals of tergite 8 long (28 μ), hind margin with long, perfect comb; tergite 9 with a row of 4 (35 μ) dorsal bristles, the laterals measure 60 μ, hind angulars 68-72 μ; glandular areas wanting, accessory bristles present, from sternites 2 to 8, numbering 2, 6, 8, 8, 7, 8, 8, in the allotype. Tarsi slender.

To the description of the female (l.c., p. 5), I have to add that the sternites 2 to 7 are provided with accessory hairs, 1-2 on sternite 2, a very regular row of about 13 on sternite 6, and an irregular (laterally doubled), one on 7.

If I had found this male-form singly, I should have placed it in the

genus *Thrips* L.; it is remarkable that in *Mycterothrips acaciae* — and perhaps in some in other species — the male has 7-jointed (fig. 5), the female 8-jointed antennae (fig. 6), and that the rostrum is very long in the female, whilst it is much shorter, almost normal, in the male.

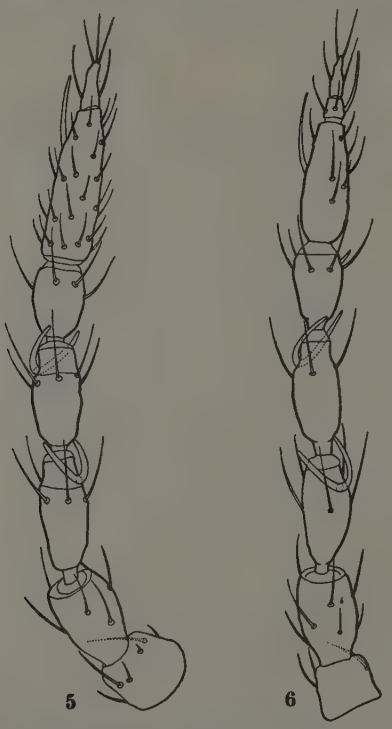


Fig. 5. — *Mycterothrips acaciae* Pr.: Antenna of male.
Fig. 6. — *Mycterothrips acaciae* Pr.: Antenna of female.

It appears to me that there is some habitual resemblance between *Mycterothrips* and *Rhopalandrothrips*.

Larva.

II. stage. — Pale yellow; eyes (composed of 4 ocelli) reddish. — Mouth-cone long, slender, pointed; head (laterally) from vertex to tip of rostrum 152 μ; palpi slender, maxillary palpi, 28, labial palpi 16 μ; cephalic bristles curved, postoculars ab. 11 μ; antennae length about 160 μ; joints from 2nd: 24, 40, 48, 10, 16 μ; most of the dorsal bristles on body *thick*,

dilated gradually towards tip, somewhat fringed apically, postero-angulars of prothorax 16-20 μ; abdomen with transversal rows of conspicuous miliary granulae, without microsetulae; dorsal bristles on segment 8 about 24-28 μ; bristles on 9 not dilated towards tip but b. 1 not quite sharp, 24-29, b. 2 setiform, 35 μ; hind margin of 9 with a row of very minute, sometimes obliterated teeth, hind margins of 9 and 10 very slightly shaded.

All the specimens were collected at Meadi, on 20.5.1936, from *Acacia arabica* var. *nilotica* (by beating by means of a Winkler-Apparatus).

33. THE EARLY STAGES OF SOME PHLAEOTHRIPIDAE.

Treherniella afra Priesner.

(Bull. Soc. Roy. Ent. d'Egypte, 1935, p. 320)

(figs. 7 and 8)

Larva (2nd stage). — Deep yellow to almost orange, with the following parts of the body more or less dark yrey : head, antennae (except the usual

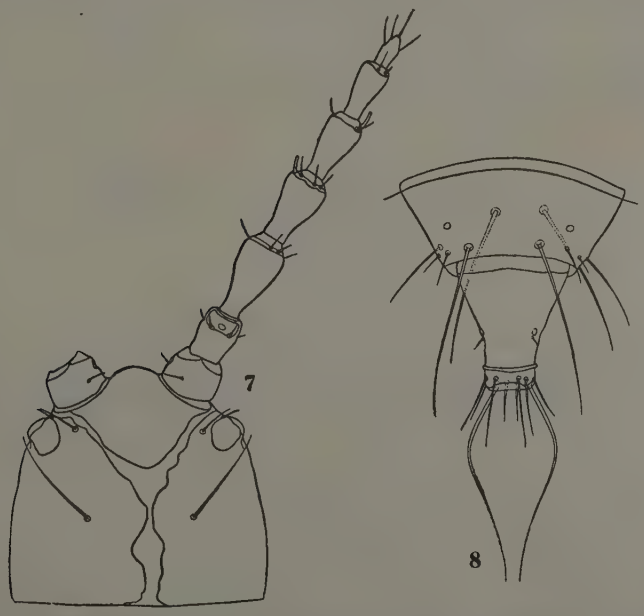


Fig. 7. — *Treherniella afra* Pr.: Head and antenna of larva, second stage.
Fig. 8. — *Treherniella afra* Pr.: Abdominal segments 9-11 of larva, second stage.

pale spot around areola on joint 2, and joint 1 somewhat paler than the remaining joints), legs, pronotal plates, 9th to 11th abdominal segments, and stigmata; there are no dark bristle-plates on thorax and abdomen.

Body rather broad and heavy; segments strongly transverse; head length 132-136, width across eyes 120-123, interantennal distance 30 μ; head somewhat hump-like produced between the antennae; cheeks somewhat rounded; two small pairs of interior eye bristles; a pair of fine bristles on the vertex (b. 1) well developed, ab. 56 μ, b. 2 ab. 20 μ, all pointed, hair-like. Antennae stout, length 235 μ, lengths (breadths) of joints : 20-22(31), 30-32(22), 44(25), 40(24), 38(22), 32(17-18), 20(9-10) μ; sense-cones on joint 4 curved, short, 8-10 μ; joint 7 entirely separated from the preceding joint. Prothorax much transverse, bristles colourless and therefore difficult to detect; b.1 in any case vestigial; b.6 : 76-80 μ, pointed, setiform; b. 7 pointed, 20-22 μ; b. 6 of mesonotum resting on an indistinct, pale grey plate, perhaps 68 μ in length; b.2 on tergite 1 ab.28 μ, curved, pointed; b.2 on segment 7 : 52, b.3 : 85 μ; dorsal bristles on 8 may be rounded at tip, length of b.3 : 40 μ; segment 9 strongly transvrese, conical, basal width 132 μ, apical width 80 μ, length ab. 45 μ; b.1 setiform, pointed, ab. 100 μ in length, b.2 short, 16-20 μ, b.3 longer, 40 μ, b.4 about as b.1; all pointed; length of segment 10, 52-55, basal width 65, apical 28 μ; anal hairs moderately long. Total body length 1.25 mm, width across metathorax 430, across 3rd abdominal segment 490 μ.

Habitat : Egypt (Wadi 'Of near Helouan), 11.III.1936, swept from grasses.

Haplothrips cameroni Priesner.
(Bull. Soc. Roy. Ent. d'Egypte, 1934, p. 31; 1936, p. 63)

(figs. 9 and 10)

Further specimens of this species, including the male and larva, were collected by Mr. W. Wittmer (18.8.1933) at Helouan, and by myself on the banks of a canal near Atar-el-Nabi (Old Cairo) on its host plant, *Diplachne fusca* L.; the insects live between culm and leaf-sheath of this grass, even on plants which are partly submerged in the water.

The male (hitherto undescribed) is identical with the female in its colour, and structurally only differs in having the fore femora more strongly enlarged in its œdymerous form. Measurements of a gynaecoid specimen, in μ : Head length (from eyes) 204, width 172; eyes length (laterally) 80; antennae length 355; lengths (widths) of joints : 25(b.36), 48(29), 50(25), 50(29), 49(27), 46(24), 46(20), 29-31(13); pronotum length 160, width 286; b.1 on segment 9 : 124, b.2 : 44, b.3 : 124; tube length 114 (dorsally), 120 (laterally), width across base 66, at apex 36.

Larva (2nd stage). — Yellow, with some red pigment cells in abdominal segments 8-10 (or only traces of them in 8); femora paler than the fibiae which are somewhat shaded at exterior margin; antennae with joints

4-5-7 more or less dark grey, 4 usually lighter grey (about as 2 in basal half), 3 pale yellow, 1 somewhat shaded ; a light grey spot between antennal base ; lateral plate of segment 8, and the whole of 9, 10 and 11 greyish, 10 and 11 darker than 9.

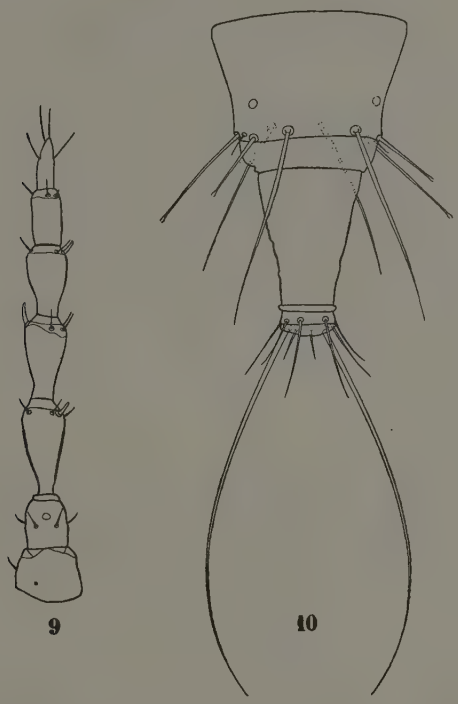


Fig. 9. — *Haplothrips cameroni* Pr. : Antenna of larva, second stage.
Fig. 10. — *Haplothrips cameroni* Pr. : Abdominal segments 9-11 of larva, second stage.

Head length about 140, width across eyes 120-125 μ, interantennal distance 28-30 μ ; inner eye bristle blunt or slightly knobbed, 32-34, b.1 on vertex ab. 44, knobbed, b.2 practically pointed, 20 μ ; antennae length 250-256 μ ; joints : 22-24(36-38), 32(24), 52(24), 44(24), 40(22), 32(16), 28(10) μ ; joint 3 thin at base, sense-cone on 4 : 12 μ, joint 6 with parallel sides, 7 entirely separated from it. B.1 of the pronotum small, pointed, 10-12 μ, b.3 blunt or knobbed, 36-44 μ, b.4 : 24, b.5 : 48, b.6 : 45-48, b.7 : 28 μ, all knobbed ; b.6 of the mesonotum knobbed, 48-52 μ ; bristles on abdomen well developed, dorsals knobbed ; b.2 on segment 1 ab. 40, b.2 on segment 7 : 52-56, b.3 : 64 μ ; bristles on segment 8 : 48, 52 and 48 μ ; length of segment

9 ab. 76, width at base, 112, at apex 83-86 μ; bristles on 9: b.1 setiform, pointed, 120 μ and more; b.2 knobbed, 44-46 μ; b.3 longer, knobbed, 60-65μ; b.4 as b.1 in shape but somewhat shorter. Segment 10:76 μ long, 56 at base) and 30 μ (at apex) broad; anal hairs long, 220-240 μ.

In its coloration, this larva is somewhat similar to that of *H. aculeatus* F. (not existing in Egypt) but the larva of *cameroni* has no forked bristles on abdominal segment 9; *H. faureanus* Pr. has the antennae less slender, bristles shorter, and also b.1 of segment 9 knobbed; the latter character can also be seen in a new swamp inhabiting species from Egypt, akin to *juncorum* Bagn., which will be described in a later issue of these « Contributions »; the larva of *H. clarisetis* Pr. (yet inedited) has the head and prothorax red, and has forked b.3 of segment 9; the larva of *H. giganteus* Pr. is quite different by its longer pronotal setae, its conspicuous bristle-plates, and the shape of the bristles on segment 9.

Laphyragogus pictus Kohl : complemento alla descrizione della femmina e descrizione del maschio

(Hymenoptera-Sphegidæ)

(con Tavola XII)

per il Dott. Alberto Mochi e il Sig. Alessandro Mochi

Il genere *Laphyragogus* è stato descritto dal Kohl nel 1889 su di una femmina catturata in Egitto. Ecco la traduzione della diagnosi generica (1) :

« Occhi reniformi che raggiungono la base delle mandibole nella femmina. Stigmi normali. Mandibole incavate all'esterno presso al mezzo. Palpi mascellari di 6 articoli, labiali di 4. Antenne setiformi di 12 articoli nella femmina. Collare appena distinto, sito molto più in basso del pronoto. Sutura episternale delle mesopleure distinta. Segmento mediano cadente a perpendicolo posteriormente, tibie e tarsi ciliati. Metatarso anteriore fornito di un processo lobiforme. Tibie intermedie con un solo sperone. Anche robuste, le intermedie vicine. Unghie senza pulvilli.

Ali grandi, con la cellula radiale lanceolata, troncata obliquamente, con tre cellule cubitali subeguali, la seconda ricevente le due nervature ricorrenti. Nervatura basale sorgente al di fuori della prima cellula submediale. Cellula submediale delle ali posteriori terminata dopo l'origine della nervatura cubitale.

Corpo a disegni giali abbondanti. Maschio per ora ignoto ».

Questo genere presenta caratteri peculiarissimi che lo pongono in rapporto da un lato con le *Larridae* (specialmente col genere *Dinetus*) e dall'altro con i *Philanthus*. Comprende una sola specie, certamente molto rara, poichè nelle collezioni a noi accessibili in Egitto non ne abbiamo trovato che un solo maschio, raccolto dal Dott. A. Honoré e noi stessi, in cinque anni di caccia, ne abbiamo raccolti un altro maschio e tre femmine. Nella letteratura, il Morice menziona una femmina catturata in Algeria, a Biskra, il 6.V.1898, e afferma di aver trovate altre femmine nei dintorni del Cairo, ma nessun maschio (2).

Data la rarità e l'interesse di questa specie, riteniamo opportuno aggiungere alla descrizione del maschio, per quanto ci è noto ancora non conosciuto, la traduzione della descrizione originale della femmina data dal Kohl ed alcuni complementi sulla base delle nostre osservazioni.

FEMMINA. -- Descrizione originale del KOHL.

« Lunghezza 8-9 mm. Nera. Addome, meno le fasce bianche, rosso arancio, passante in parte al nero. Corpo a disegni abbondanti, senza dubbio variabili.

(1) *Annalen des naturhistorischen Hofmuseums Wien*, 1889, IV, pag. 190.

(2) Morice, *Transactions of the entomological Society of London*, 1911, p. 107.

Giallo pallido sono : il clipeo in parte, qua e là il pronoto, i calli omerali, le scagliette, una macchia subito al disotto, il margine posteriore e i laterali dello scutello, il postscutello, due grosse macchie laterali sul segmento mediano, larghe fasce sui segmenti addominali; i due terminali sono tutti gialli al disopra, come pure gialli sono le tibie, i tarsi e in parte i femori, che però presentano parti ocracee. Le ali sono jaline con le nervature gialle. Pubescenza bianca.

Mandibole appuntite, semplici, incavate al margine esterno verso il mezzo, un pó più verso la base che verso l'apice. Clipeo assai piatto, col margine anteriore arcuato. Occhi leggermente reniformi, distanti fra loro al vertice della lunghezza del 2°+3°+4° articolo del funicolo. Ocelli posteriori distanti fra loro quanto dagli occhi. Il vertice non si prolunga quasi affatto dietro gli occhi ed anche le tempie sono molto sottili. L'incavo trapezoidale dell'occipite è marginato ed assai grande. Le inserzioni antennari distano fra loro circa della lunghezza del 3° articolo del funicolo. Lo scapo è assai più corto del 2° articolo del funicolo; il 1° è globoso, il 2° due volte e mezzo più lungo che largo, il 3° a 6° appena due volte, cilindrici. Fronte e vertice a puntuazione evidente e assai fitta, la fronte un poco convessa.

Collare molto basso, quasi invisibile. Dorsulo lucente, scarsamente punteggiato nella parte mediana, più sui lati. Scutello piatto, liscio e lucente, con punti isolati. Mesopleure coriacee, rugose, opache. Metapleure infossate. Segmento mediano più largo che lungo, cadente a picco indietro, reticolato-rugoso sulla superficie dorsale, sul resto coriaceo-rugoso. Addome a scultura finissimamente reticolato-rugosa, assai poco convesso; valva anale superiore piana, triangolare.

Anche molto sviluppate, femori sottili, gli anteriori ciliati su di una linea al margine inferiore, le tibie tutte ciliate. Il tarso anteriore ha una forma speciale : il metatarso sembrerebbe non più lungo dell'articolo seguente se non fosse prolungato al lato esterno da una lunga appendice lobiforme; anche il 2°, 3° e 4° articolo sono asimmetrici per la presenza di un'appendice al lato esterno. I primi 4 articoli dei tarsi anteriori portano al lato esterno un lungo pettine. I tarsi intermedi e posteriori sono ciliati tutt'intorno. Lo sperone delle tibie posteriori raggiunge quasi in lunghezza il metatarso, che è lungo quanto i tre articoli seguenti insieme.

Per le nervature alari, si veda la figura. Nel tipo il retinacolo è continuo ed ha 13 uncini ».

A questa descrizione, del resto ottima come tutte quelle del Kohl, possiamo aggiungere quanto segue (3) :

La grandezza e il colore sono effettivamente variabili. Dei tre esemplari studiati, due, uno catturato a Abu Rawash il 23.V e l'altro al Gebel Asfar il 27.V sono lunghi 12,5 mm., il terzo, catturato al Gebel Asfar il 4.VI, è

(3) Per quanto riguarda la terminologia, intendiamo per torace la parte del corpo che va dal collare alla fine del segmento mediano o propodeo. E assurdo infatti fare intervenire concetti embriologici quando si tratta di delimitare topograficamente delle regioni anatomiche : ciò non si fa in nessuna branca dell'anatomia. Perciò il segmento addominale che viene subito dopo il propodeo (peziolo) è per noi il primo e non il secondo come per il Kohl. Nell'indicare le varie parti abbiamo adottata la nomenclatura anatomica stabilita dai congressi dove ciò non diveniva ridicolo o oscuro : chiamiamo perciò laterali le parti che si allontanano dalla lina mediana, *mediali* quelle che vi si avvicinano; *prossimali* quelle che più si avvicinano al centro del corpo, *distali* quelle che se ne allontanano. Abbiamo scartato invece i termini *craniale* e *caudale*, sembrando ridicolo negli insetti fare allusione ad un cranio e ad una coda che questi non posseggono neppure filogeneticamente.

lungo 9 mm. Nessuno dei tre corrisponde esattamente alla descrizione del Kohl per i colori, per quanto l'aspetto generale non lasci adito a dubbi quanto alla pertinenza specifica. L'addome è giallo-ocra, senza tracce di fasce bianche o di passaggio al nero; nei due esemplari più grandi il bordo dei segmenti soltanto e il pigidio sono rosso-ocra; nel più piccolo sono di quest'ultimo colore la superficie anteriore (verticale) del 1° e due fasce larghe sul bordo prossimale del 2° e 3° segmento. In questo esemplare le macchie del torace e della testa sono tutte giallo paglierino, nei più grandi invece sono in parte gialle e in parte rossastre. Senza dubbio l'esemplare piccolo è il più vicino alla descrizione originale, ha però in più di color giallo gli angoli del dorsulo, le parti che raccordano lo scutello e il post-scutello con la regione delle inserzioni alari, tutta la parte laterale e i margini della parte mediana del segmento mediano. Lo scapo delle antenne è però nero (giallo negli altri esemplari pur a disegni più scarsi), i femori delle zampe intermedie sono neri sulla faccia mediale, quelli delle posteriori rosso-ocra. Nei due esemplari più grandi i disegni chiari della testa e del torace sono meno abbondanti. Tutti gialli sono : il clipeo, lo scapo delle antenne, il post-scutello, le scagliette e le macchie sotto di esse. Rosso ocra (molto scuro, tendente al nero, in un esemplare) sono : lo scutello, i calli omerali, una parte dei lati del segmento mediano e lo spazio interantennare subito al disopra del clipeo.

La parte media del clipeo non è affatto separata dalle parti laterali, le quali però se ne distinguono per una netta differenza di scultura : al mezzo vi sono solo scarsi punti mediocri e superficiali, sui lati punti fini e fitti. Gli occhi convergono un poco verso l'alto, distano quindi fra di loro un poco più all'altezza del clipeo che al vertice. Gli ocelli sono disposti secondo un triangolo la cui base è assai più lunga dei lati. La faccia, da subito al disotto degli ocelli a prima dell'inserzione antennare, è leggermente convessa con al mezzo un'infossatura longitudinale quasi lineare priva di scultura che va dall'ocello anteriore fin poco al disopra dell'inserzione delle antenne. Un'occhiata allo schema della fig. 9 della Tavola XII darà un'idea della scultura in questa regione. Fra la convessità e i margini oculari invece la faccia è leggermente concava, un pó più in basso che in alto e ricoperta di una fittissima pubescenza argentea che ne nasconde la scultura. Il vertice, come si è detto, non si prolunga dietro gli occhi, anzi è qui incavato al mezzo. La parte declive che segue il margine supero-posteriore degli occhi è liscia e lucente a piccolo ingrandimento, ma a 70 diametri presenta una reticolazione finissima, regolare. Le antenne nel loro insieme sono subcilindriche : la larghezza del 2° articolo del funicolo al suo estremo distale sta a quella del penultimo al suo estremo prossimale come 15 sta a 18.

La forma del dorsulo è caratteristica a causa della situazione del collare. Questo è posto talmente in basso che è assolutamente invisibile dall'alto se l'insetto non ha la testa profondamente inflessa in avanti, e per osservarlo occorre metter il preparato di profilo. Il dorsulo è quindi obbligato ad inflet-

tersi in basso prendendo una direzione verticale. Al mezzo del dorsulo la scultura è rappresentata da punti scarsi, molto distanti fra loro, mentre sulla parte verticale anteriore, sui lati e in immediata vicinanza della sutura che separa questa parte dallo scutello i punti sono molto più fitti. Le parti lisce e lucenti del dorsulo, dello scutello e del postscutello sono, anche a fortissimo ingrandimento, prive di scultura. Le ali sono molto grandi, le posteriori specialmente amplissime come nelle tentredini. Nei tre esemplari studiati (ed anche nei due maschi) si trova costantemente una falsa nervatura longitudinale che divide trasversalmente la prima cellula cubitale e che quindi si può porre fra i caratteri della specie e del genere, poichè anche il Kohl la ha figurata due volte, pur senza menzionarla, una nel già citato lavoro, e un'altra in quello sui generi delle *Sphegidae* (4). Il retinacolo, che si origina subito dopo la nervatura radiale delle ali inferiori, ha 12 uncini nell'esemplare piccolo e 16 nei due grandi.

Le figure 4, 5 e 6 della Tavola XII dànno un'idea della forma e dei rapporti di grandezza delle tre paia di zampe. Le spine del pettine, molto più lunghe di quanto sembri dalla figura del lavoro originale del Kohl, incurvate ad arco, sono inserite non solo sulla faccia laterale del prolungamento lobato del metatarso anteriore, ma lungo tutto il suo bordo anche sul lato mediale. Osservando l'organo dal lato ventrale si possono contare (25 nell'esemplare studiato). Le unghie sono notevolmente lunghe, del tutto prive di pulvilli. Le anche anteriori presentano sul lato mediale un piccolo prolungamento ciliato (Tavola XII, fig. 10) non descritto dal Kohl.

Dal lato ventrale, il prosterno presenta punti finissimi ben separati, visibili solo a forte ingrandimento, ma appare liscio a ingrandimento piccolo. Il mesosterno è liscio, con scarsi punti visibili anche a piccolo ingrandimento, convesso sui lati, con un largo incavo trapezoidale al mezzo sulla metà anteriore; sui lati è netta la sutura episternale che delimita, esternamente all'incavo, uno spazio semi-ovalare, piuttosto opaco, con punti scarsi e molto superficiale sopra un fondo finissimamente reticolato-striato.

L'addome, dall'inizio della declività anteriore al margine del 4° segmento, ha una lunghezza eguale ai 4/5 di quella del torace. Il pigidio ricorda quello dei *Philanthus* e porta grossi solchi longitudinali superficiali e 4 o 5 punti grossi e profondi, su di un fondo lucentissimo, ma finissimamente reticolato se veduto a 70 diametri. La reticolazione dei tergiti è più grossa e questi appaiono perciò semi-opachi; quella degli sterniti è analoga a quella del pigidio e quindi essi appaiono lucenti.

MASCHIO (inedito). — Descrizione del tipo :

Lunghezza 11 mm. Per il colore simile alla femmina, ma con la testa, le antenne e il torace tutti neri, salvo le scagliette e una sottile fascia al bordo

(4) *Annalen des naturhistorischen Hofmuseums Wien*, XI, 1896.

posteriore del postscutello, che sono gialle. L'addome è giallo-ocra : sono rosso-ocra le faccia anteriore (verticale) del 1° segmento, i margini distali dei seguenti, in piccola parte il margine prossimale del 2° e del 3°, larghe macchie laterali sulla parte distale del 3° e su tutto il 4° e il 5° e il pigidio. Colorazione delle zampe, nervature alari ed ali come nella più piccola delle femmine.

La forma della testa è analoga a quella della femmina, solo la faccia e la fronte sono molto più strette e gli occhi molto più convergenti verso l'alto, talchè distano al clipeo quasi due volte più che al vertice. In rapporto con la maggior convergenza degli occhi, la distanza che separa i due ocelli posteriori l'uno dall'altro è doppia di quella che separa ciascun ocello dall'occhio corrispondente. La scultura della faccia e del vertice è analoga a quella dell'altro sesso; le parti laterali concave della faccia sono egualmente coperte di pubescenza argentea abbondante, ma esistono inoltre lunghi peli eretti dello stesso colore sparsi abbondantemente sia al disopra che al disotto della regione degli ocelli. Mandibole come nella femmina, guance assenti come in questa. Labbro assai lungo, bilobato; palpi mascellari di 6 articoli, labiali di 4 come nella femmina. Le antenne, di 13 articoli, a inserzioni molto ravvicinate fra loro e molto vicine al margine superiore del clipeo, hanno lo scapo e i primi due articoli del funicolo analoghi per lunghezza e forma a quelli della femmina, mentre il terzo e il quarto presentano una deformazione caratteristica : visto di profilo, il terzo articolo è incurvato, con la convessità rivolta verso l'alto, e il quarto è un pó più largo all'estremo distale che al prossimale. Nell'insieme il funicolo è più clavato che nell'altro sesso: la larghezza del 2° articolo al suo margine distale sta a quella del penultimo al suo margine prossimale come 10 sta a 17.

La forma e la scultura del torace non presentano differenze sensibili per rapporto all'altro sesso; anche la grandezza e la nervatura delle ali sono identiche a quelle della femmina. Le zampe sono nell'insieme meno spinose e meno tozze che nella femmina. Il metatarso anteriore è di forma normale, assai sottile, lungo circa quanto quello della femmina se vi si comprende il lobo laterale, con 9 spine al pettine. Il piccolo prolungamento mediale sull'anca anteriore è appena accennato e egualmente fornito di peli assai lunghi. Contrariamente a quanto avviene nella femmina, le unghie sono eccessivamente corte, munite di pulvilli neri molto bene sviluppati.

L'addome ha 7 segmenti visibili. Il pigidio è più allungato che nella femmina, a scultura analoga. Gli ultimi due segmenti sono riccamente forniti di peli chiari inseriti ventralmente. Dal lato ventrale, la valva anale è bilobata e carenata al mezzo; il 6° segmento porta su ciascun lato una sporgenza accentuata, in parte nascosta dai peli, di forma quasi piramidale ed è leggermente concavo al mezzo; il 5° ha il margine distale leggermente ingrossato; il 4° ha al mezzo di questo margine un rilievo disposto trasversalmente, assai sviluppato, che si perde sui lati; il 3° due rilievi egualmente

trasversali, molto meno elevati, che si perdono al mezzo; il 1° un largo incavo mediano rotondeggiante.

Il maschio della collezione Honoré (co-tipo) è molto più piccolo del nostro : per quanto abbia tutti i segmenti addominali distesi all'estremo, falchè l'addome appare notevolmente più lungo del torace, non misura più di 8 mm. Differisce sopratutto dal tipo per avere un aspetto molto più snello, essendo il diametro trasverso sia del torace che dell'addome molto minore per rapporto alla lunghezza. Per quanto riguarda il colore, è identico al tipo al torace (salvo forse il giallo un pò più esteso sul post-scutello) ed ha i margini distali dei segmenti addominali molto più scuri, tendenti al nerastro (forse il colore scuro è più visibile perchè i segmenti non si sovrappongono quasi punto). Per quanto riguarda i caratteri anatomici, non si differenzia dal tipo, solo i rilievi della superficie ventrale dell'addome sono così poco accentuati che sarebbero certo sfuggiti se la descrizione fosse stata fatta su questo esemplare. Non si riesce neppure a vedere il piccolo prolungamento sull'anca anteriore a causa della difettosa preparazione. I peli sono molto meno abbondanti, evidentemente consumati. Si ha l'impressione di esser dinanzi ad un individuo scarsamente sviluppato e molto vecchio, cioè guastato dal volo.

Tipo: Gebel Asfar, 4.VI.1937 (nella nostra collezione).

Co-tipo: Sakkara, 15.IV.1934 (nella collezione Honoré).

Il maschio di questa curiosa specie è ancor più raro della femmina e non meno interessante di questa; la forma delle antenne e i rilievi sui segmenti ventrali, oltre ai caratteri generici, gli dànno un aspetto anormale e altamente caratteristico. In seguito alla sua scoperta, è necessario modificare la descrizione del genere, cui si deve aggiungere :

Guance assenti nei due sessi; prima cellula cubitale divisa trasversalmente in due parti eguali per mezzo di una falsa nervatura longitudinale; pulvilli assenti nella femmina, presenti e notevolmente sviluppati nel maschio.

TAVOLA XII

Spiegazione della Tavola XII

Laphyragogus pictus Kohl

Fig. 1. — Testa vista dal davanti.

Fig. 2. — Testa vista dal disopra.

Fig. 3. — Antenna.

Fig. 4. — Tibia e tarso anteriore.

Fig. 5. — Tibia e tarso intermedio.

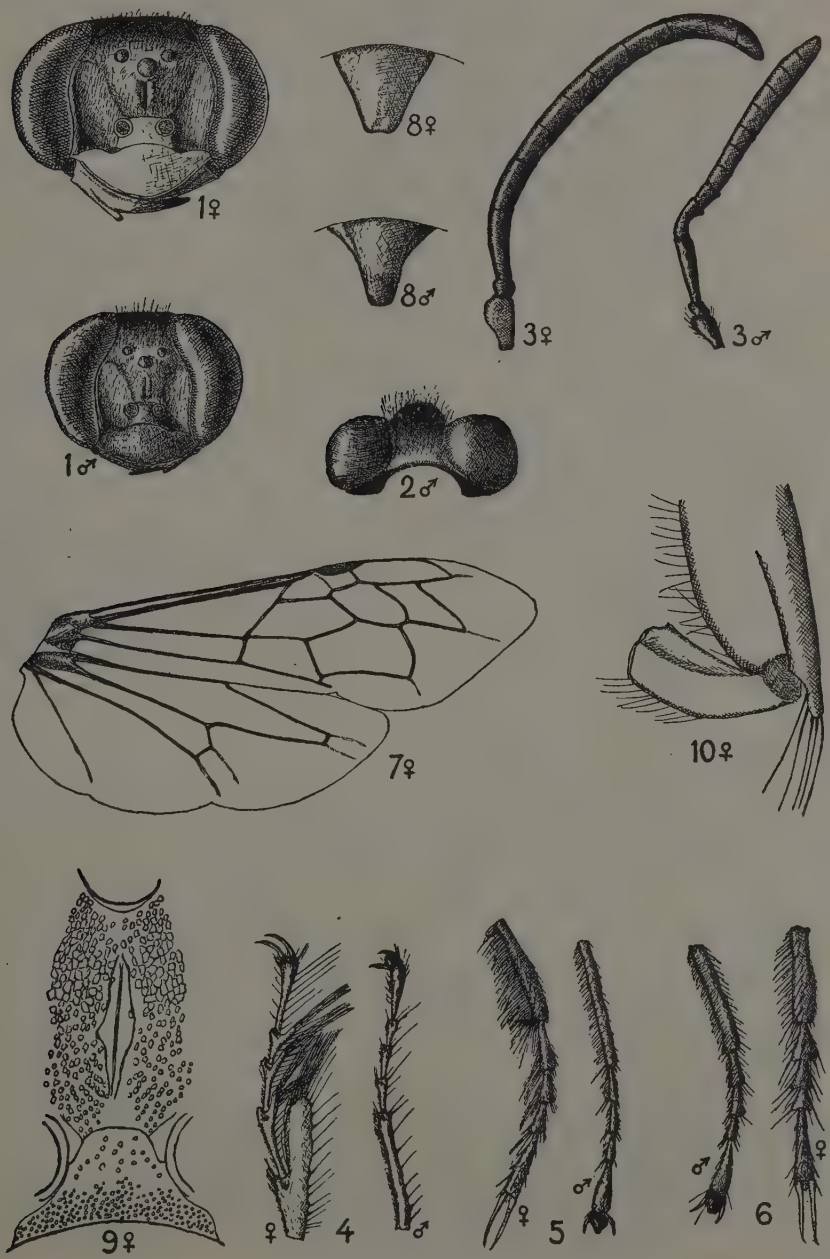
Fig. 6. — Tibia e tarso posteriore.

Fig. 7. — Ali.

Fig. 8. — Pigidio.

Fig. 9. — Schema della scultura della faccia.

Fig.10. — Anca anteriore.



Laphyragogus pictus Kohl

Séance du 22 Décembre 1937

Présidence de Monsieur le Prof. H. C. Efflatoun Bey, *Vice-Président.*

Dons à la Bibliothèque :

La Société a reçu les ouvrages mentionnés ci-dessous :

1° De Monsieur A. Hustache, de Lagny (France) : un tiré à part de chacun de ses cinq récents travaux sur les Curculionides.

2° De Monsieur le Prof. Paul Marchal, de Paris : un exemplaire de son ouvrage « Recherches sur la biologie et le développement des Hyménoptères parasites : les Trichogrammes », extrait des Annales des Epiphyties et de Phytogénétique, Tome II, fasc. 4, 1936.

3° De Monsieur le Dr. Kamel Mansour, du Caire : un separata de chacune de ses études intitulées (a) The Development of the Adult Mit-Gut of Coleopterous Insects and its Bearing on Systematics and Embryology (Bulletin of the Faculty of Science, No. 2, The Egyptian University, Cairo, 1934) ; (b) On the Cellulase and other Enzymes of the Larvae of *Stromatium fulvum* Villers (Family Cerambycidae), extrait de Enzymologia, Vol. IV, La Haye, 1937 ; (c) On the Intracellular Micro-organisms of some Bostrychid Beetles, extrait du Quarterly Journal of Microscopical Science, Vol. 77, II, Oxford University Press, 1934.

4° De Monsieur le Docteur W. Junk, de La Haye (Hollande) : Les parties 148-156 du Coleopterum Catalogus, parues du 15.8.1936 au 16.8.1937.

Le Conseil remercie.

Don d'insectes :

Monsieur le Dr. Wilhelm Boenner, professeur à l'Ecole Allemande du Caire, quittant définitivement l'Egypte, fait parvenir une collection de fourmis égyptiennes représentées par 200 exemplaires environ.

Le Conseil remercie.

Nomination :

Sur la proposition de Messieurs le Prof. H.C. Efflatoun Bey et A. Alfieri, Monsieur H.E. Biggs, du Caire, est admis à faire partie de la Société en qualité de membre titulaire.

Contrat du Conservateur :

Le contrat du Conservateur de la Société est renouvellé pour une nouvelle période de trois années, à partir du 1er Avril 1938, aux termes et conditions précédemment fixés.

Preliminary Results of Investigations on the Relation between the Attack of *Prodenia litura* Fabr. and *Thrips tabaci* Lind. on Cotton

(with 28 Tables and Graphs)

by Dr. Abdel Aziz Ali Elsayed Ghabn

During the course of my research on the control of *Thrips tabaci* Lind. on cotton this year, it struck me to collect figures relating to the attack of the cotton-worm, *Prodenia litura* in June and the effect of this, regarding the various stages of the cotton plant on one side and the different varieties on the other, and to know the relation between *Thrips* attack and that of *Prodenia* on cotton.

My attention was drawn to this by the fact that I noticed that during last year, the degree of infestation by *Prodenia litura* by the same brood was not uniform, either for one variety of cotton in different stages of growth, or for different varieties in the same stage of growth. These observations were facilitated by the original programme of my experiments laid down for the control of thrips, which comprised the study of the different dates of sowing of cotton and their relation to the degree of infestation by thrips and the degree of resistence of the different cotton varieties to thrips attack.

On discussing my ideas on collecting figures on *Prodenia* infestation with Prof. Dr. H. Priesner, the Director of the Entomological Section, Ministry of Agriculture and Ibrahim Bishara Eff., Senior Entomologist on cotton pests, I was encouraged to carry out my plan concerning this point. I was fortunate in being able to collect the desired data. Due to the importance of the results obtained, I thought it advisable to publish these notes including the Figures and explanatory Graphs. Before doing this I find it necessary to explain parts of my original programme on thrips control on cotton and summarise the points which have a bearing on the subject of this note in the following:

According to the above mentioned original programme, cotton was sown this year in nine different dates beginning with February 15th and ending with May 5th, with intervals of 10 days between sowings. For each date of sowing was given a section containing eight different varieties of cotton:

1. Sakel Domain ; 2. Sakel ; 3. Sakha 4 ; 4. Maarad ; 5. Giza 7 ; 6. Giza 12 ; 7. Giza 19 ; 8. Giza 26.

These varieties were repeated three times, each variety was divided into four plots, two of which were treated and the other two left without treatment. In treated and untreated plots, one plot was resowed and the second left without resowing. The data concerning the degree of infestation of cotton by the June brood of *Prodenia litura* was collected in three intervals, the first on the 10th, the 2nd on the 20th, and the 3rd on the 30th of June.

It may be noticed that the arrangement of irrigation was different at first according to the different dates of sowing. But due to the desire to simplify irrigation in the future, these intervals were adjusted so that they fell together for the first time on the 22nd of June, on which date all the plots in all sections were given the one irrigation in this month. The other treatments in all sections were completely the same.

In the following is given the Figures and explanatory Graphs for this purpose, for each variety and in each date of sowing. We may mention that comparison is given to show the degree of infestation by *Prodenia litura* i.e. average total number of egg-masses per feddan, in the three intervals of June for the treated and untreated plots i.e. average of resowed and not resowed, in the following cases :

a. — For each variety separately in each of the different dates of sowing (Tables and Graphs I-XVI).

b. — For total average of the whole variety in each of the different dates of sowing (Tables and Graphs XVII and XVIII).

c. — For total average of each variety separately by total average of the whole different dates of sowing (Tables and Graphs XIX and XX).

Referring to Figures and Graphs the following conclusions can be drawn :

1. — There is a correlation with regard to the degree of infestation by *Prodenia litura* on cotton, when we compare the different varieties with reference to the different dates of sowing. These varieties resemble each other, except for minor differences which can be ignored without influencing the significance of these figures (Tables and Graphs I-XVI).

2. — The degree of infestation by *Prodenia* increases progressively in general as the date of sowing is retarded (Tables and Graphs XVII and XVIII).

3. — There is some irregularity in the upward trend of the Graphs of infestation as mentioned in the above paragraph. These irregularities are shown in the first, third, and fourth sections as compared with the second. Then in the seventh, eighth, and ninth sections as compared with the fifth and sixth. These differences are contrary to the expectations with regard to the upward trend of infestation.

The explanation for these phenomena is mostly due to the condition of growth on the one side, and the average total number of plants, leaves, and vegetative parts of plants per feddan on the other, both of which depend on the age of the plant. The average total number of egg-masses per feddan i.e. degree of infestation, depends on a large extent on the above mentioned conditions. This explains the reason why the degree of infestation by *Prodenia* appears higher in the second section than in the first, third, and fourth sections due to the unfavourable ecological conditions for germination in the first section, and to the adverse effect of *Thrips tabaci* on cotton in the third and fourth sections, during its critical period. This agrees with the results of my experiments of the previous season and the present one. We will discuss this point again later in the eighth paragraph.

With regard to the fifth and sixth sections, the damage by thrips fell to a low degree due to the progressive decrease of the intensity of population of this insect beginning from the end of April and the following dates. This decrease dropped to such a level as no danger to cotton could be expected from thrips. All this rendered the state of growth suitable to the *Prodenia* moths, so that the degree of infestation by this insect appeared more prominent in the fifth and sixth sections than in the preceding ones, on the one side and the succeeding three sections on the other.

Although the average total number of plants in the seventh, eighth and ninth sections is not less than in the fifth and sixth, but probably increases, and although the condition of growth is satisfactory and the vegetative parts are abundant, yet the average total number of leaves and vegetative parts per plant and respectively per feddan has an important bearing on the degree of infestation by *Prodenia*. The average total number of leaves and vegetative parts per feddan depends, as already mentioned, on the age of plant, even when the average total number of plants per feddan is the same. The degree of infestation by *Prodenia litura* in the early planted cotton i.e. from date of sowing till June, is less (despite the increase of average total number of leaves per feddan) than in the later planted cotton. This is due to the fact that the greatest number of the leaves in the early planted cotton have hardened.

Although the vegetative parts of the later sown plants are abundant, yet the average total number of the leaves is less in the ninth section (one month old) than in the eighth (one and half months old). According to this point of view, the average total number of leaves per feddan should be more in the seventh section (two months old) than in the 8th, but this is not the case due to the fact that a large proportion of the plants in the seventh section is effected by infiltration from the neighbouring water-channel.

4. — The most susceptible variety of *Prodenia litura* is Sakel Domain and Sakel, and the least is Giza 19. The remaining varieties fall in a descend-

ing order as follows : Giza 12, Maarad, Sakha 4, Giza 7, and Giza 26 (Tables and Graphs XIX and XX).

5. — The order of susceptibility of cotton varieties to *Prodenia* as mentioned in the above paragraph, was arrived at by calculating the average total number of egg-masses per feddan for each variety, taken for the total average of the whole different dates of sowing and comparing these averages with each other without reference to the differences among the actual average of total number of plants per feddan of these different varieties. In case of considering these differences and their effect on raising or lowering the degree of infestation by *Prodenia* as a result of the increase or decrease of average total number of plants per feddan, this adjustment does not effect the order of susceptibility of cotton to *Prodenia* as mentioned above. This adjustment was done by chosing a constant number of plants (48,000) and considering it as a maximum for average total number of plants per feddan for each variety, then finding out the co-efficient of this maximum number to actual one, multiplying the co-efficient by the average total number of egg-masses per feddan for each variety, and finally comparing the resulting figures with each other. This has shown that the above-mentioned adjustment does not influence the order of susceptibility of the different varieties of cotton to *Prodenia*, despite the increase of degree of infestation in general and the difference of the ends of the Graphs to their state before adjustment (Tables and Graphs XXV-XXVIII).

6. — In case we replace the average maximum number of plants per feddan by the average maximum number of holes (24,000), the degree of susceptibility of the different varieties of cotton to *Prodenia* is not effected either (Tables and Graphs XXI-XXIV).

7. — The degree of infestation decreases in the treated than in the untreated plots in general. This is due either to the effect of *Thrips tabaci* on cotton on the one hand or the effect of the insecticide (Urania green-Lime-Mollasses- and Nicotine Sulphate). On the other hand, either directly, or indirectly, as the result of the physiological changes which occur in the cell-sap, osmotic cell pressure and their relation to the degree of infestation by *Prodenia*, such changes which appear prominently after irrigation.

8. — The damages to cotton by *Thrips tabaci* generally increases the degree of infestation by *Prodenia* as it is shown by comparing treated and untreated plots. This is due to the retardation of growth in the untreated plots and the continuation of the vegetative growth for a longer time and in such a condition which makes it more susceptible to *Prodenia*.

In a few cases the degree of infestation by *Prodenia* appears less in the untreated than in the treated plots (which is contrary to above statement), but this is due to the decrease of average total number of plants per feddan (as a direct loss of plants by thrips) in the untreated than in the treated

ones; and as a consequence of which a decrease of the infestation by *Prodenia* occurs for the same reasons mentioned already in the third paragraph with regard to the degree of infestation and its relation to the average total number of plants, leaves, and vegetative parts per feddan, and to the stage of growth.

9. — The degree of infestation for the different dates of sowing and the different varieties of cotton increases directly after irrigation as is shown clearly from the angles of the Graphs (for each time of sowing) directly after the 20th of June which is the date just preceding irrigation.

We may mention that these results are not final and they should be considered as only applicable to the locality of Kafr-el-Sheikh under ecological factors occurring there in the year 1937, and that these results are liable to alteration according to various conditions of time and locality.

Table and Graph I.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : SAKEL DOMAIN.

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	40.32	67.83	85.68	124.95	104.58	62.74	17.85	108.15	52.29
	U	9.45	57.12	57.12	29.61	41.58	15.33	16.59	109.41	67.83
20 June	T	57.12	43.89	67.83	46.41	46.41	10.71	5.88	26.04	4.62
	U	32.13	90.51	67.83	35.70	60.69	9.45	16.59	10.71	9.45
30 June	T	74.97	283.08	195.09	172.41	296.31	422.31	349.86	403.41	240.24
	U	105.84	380.73	204.54	237.93	659.19	665.07	360.57	487.83	546.21

T = Treated U = Untreated

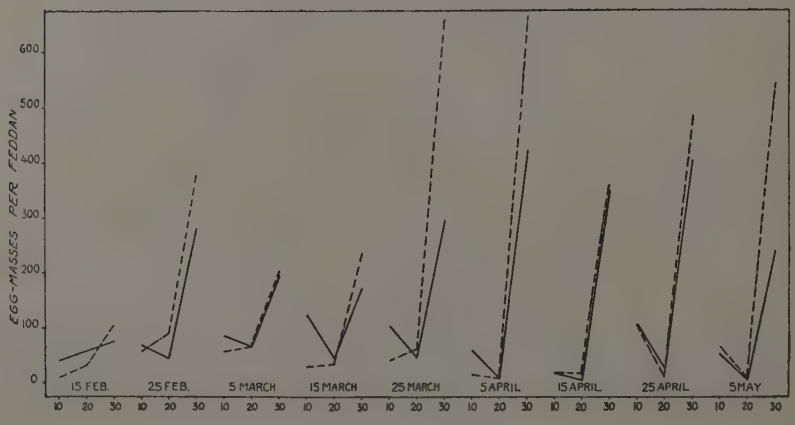


TABLE AND GRAPH II.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : SAKEL DOMAIN.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	57.47	131.60	116.20	114.59	149.10	165.25	124.53	179.20	99.05
U	49.14	176.12	109.83	101.08	253.82	229.95	131.25	202.65	207.83
A	53.30	153.86	113.01	107.83	201.46	197.60	127.89	190.92	153.44

T = Treated U = Untreated A = Average

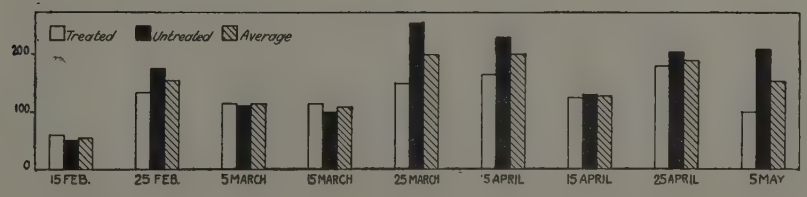


Table and Graph III.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : SAKEL

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	29.10	20.16	26.04	101.01	146.37	15.33	4.62	93.66	67.83
	U	15.33	24.99	33.18	—	—	4.62	17.85	102.06	49.98
20 June	T	135.66	78.54	32.13	72.45	36.75	15.33	26.04	14.28	—
	U	20.66	48.72	67.84	11.76	79.59	4.62	—	38.01	—
30 June	T	131.88	183.12	73.71	122.43	346.29	542.64	295.05	317.73	278.46
	U	168.84	236.67	148.68	270.06	486.57	556.88	435.54	560.49	210.63

T = Treated U = Untreated

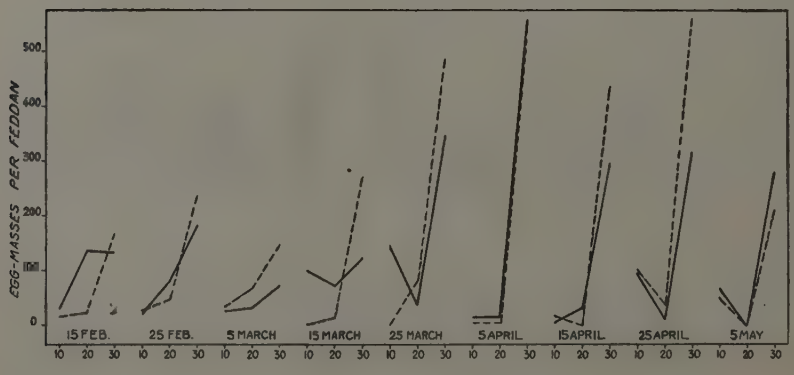


TABLE AND GRAPH IV.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : SAKEL

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	98.88	93.94	43.96	98.63	176.47	191.11	108.57	141.89	115.43
U	68.27	103.46	83.23	93.94	188.72	222.04	151.13	203.52	86.87
A	83.57	98.70	63.59	96.28	182.59	206.57	130.35	172.70	101.15

T = Treated U = Untreated A = Average

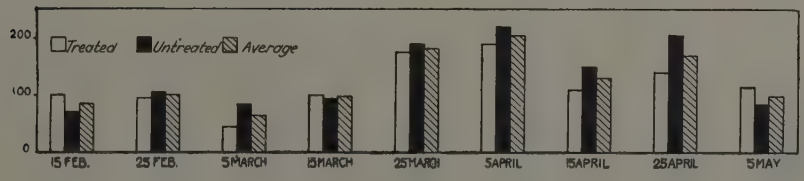


Table and Graph V.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : SAKHA 4.

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	—	26.04	33.18	32.13	53.55	16.59	5.88	89.25	32.13
	U	—	26.04	9.45	—	4.62	29.61	5.88	109.40	10.77
20 June	T	29.61	76.02	49.98	51.03	41.32	11.76	—	10.71	5.88
	U	10.71	20.16	43.89	20.16	41.37	5.88	5.88	5.88	—
30 June	T	29.61	195.09	46.41	137.97	259.35	541.38	345.03	187.95	192.57
	U	124.95	249.09	154.56	189.21	556.92	474.60	478.38	439.11	235.62

T = Treated U = Untreated

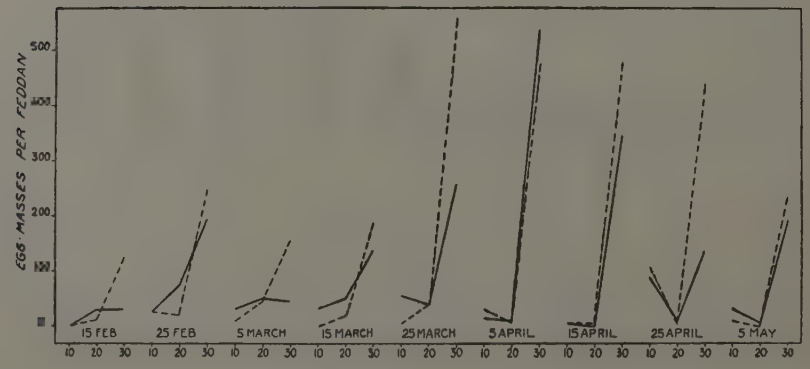


Table and Graph VI.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : SAKHA 4.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	19.74	99.05	43.19	73.71	118.07	189.91	116.97	95.97	76.86
U	45.22	98.43	69.30	69.79	200.97	170.03	163.38	184.79	82.13
A	32.48	98.74	56.24	71.75	159.52	179.97	140.17	140.38	79.49

T = Treated U = Untreated A = Average

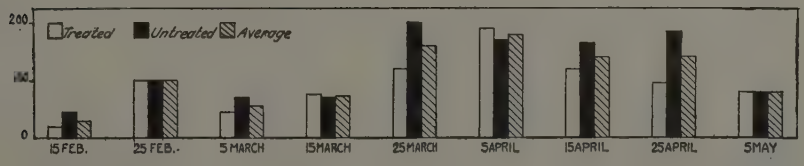


Table and Graph VII.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : MAARAD

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	5.88	51.03	39.27	9.45	73.71	4.62	22.47	120.75	60.69
	U	—	4.62	21.42	—	4.62	4.62	5.88	128.52	—
20 June	T	16.59	57.12	49.98	84.42	94.39	15.33	22.47	14.28	26.04
	U	111.72	39.27	38.01	9.45	38.01	22.47	5.88	21.42	4.62
30 June	T	57.12	115.71	33.18	90.30	332.01	486.57	42.84	333.86	220.08
	U	57.12	232.05	78.54	89.25	790.02	616.35	374.85	467.67	183.12

T = Treated U = Untreated

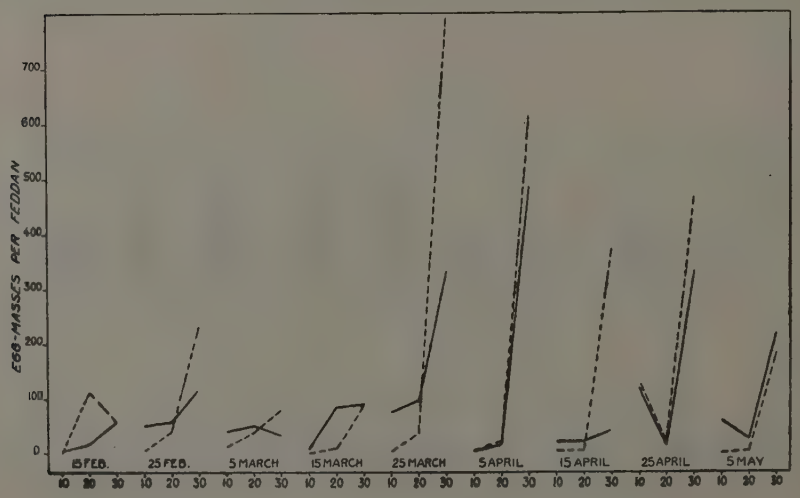


TABLE AND GRAPH VIII.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : MAARAD

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	26.53	74.62	40.81	61.39	166.70	168.84	29.26	156.03	102.27
U	56.28	91.98	45.99	32.90	277.55	214.48	128.87	205.87	62.58
A	41.40	83.30	43.40	47.14	222.12	191.66	79.06	180.95	82.84

T = Treated U = Untreated A = Average

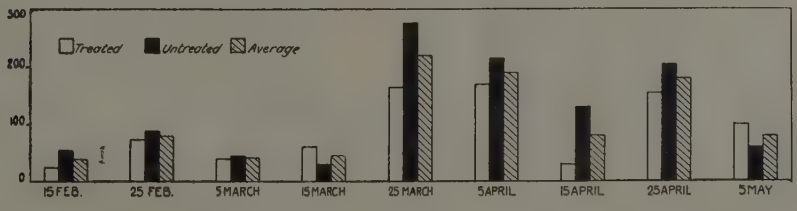


Table and Graph IX.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : GIZA 7.

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	—	15.33	28.56	4.62	73.71	15.33	22.47	46.41	21.62
	U	—	4.62	—	—	5.88	14.28	10.71	67.83	—
20 June	T	22.47	43.89	11.76	22.26	61.74	15.33	29.61	30.87	4.62
	U	21 42	21.42	22.47	10.71	28.56	27.30	16.59	21.42	—
30 June	T	40.15	55.86	34.44	67.83	149.94	63.63	418.74	472.29	195.09
	U	11.76	68.88	74.97	40.32	323.61	672.21	265.23	374.85	86.73

T = Treated U = Untreated

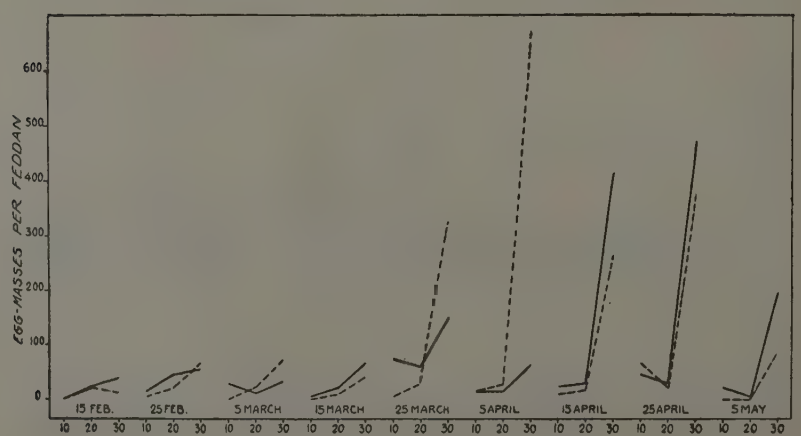


Table and Graph X.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : GIZA 7.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	22.54	38.36	24.92	31.57	95.13	31.43	156.94	183.19	73.77
U	11.06	31.64	32.14	17.01	119.35	237.93	97.51	154.70	28.91
A	16 80	35.00	28.53	24.29	107.24	134.88	127.22	168.94	51.34

T = Treated U = Untreated A = Average

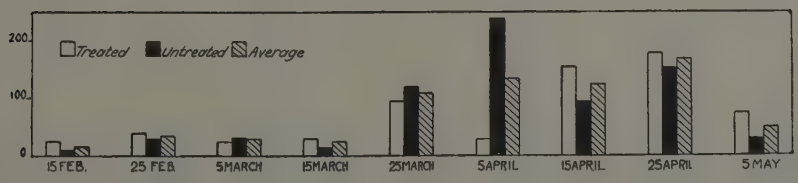


Table and Graph XI.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : GIZA 12.

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	5.25	11.13	5.67	11.55	29.61	5.25	—	119.91	24.15
	U	—	—	81.18	—	—	10.50	—	99.96	—
20 June	T	—	6.30	22.47	22.26	5.25	9.03	—	30.03	24.36
	U	15.76	15.76	31.08	12.18	6.09	12.81	12.39	17.22	—
30 June	T	59.43	73.71	82.11	85.68	223.01	686.49	401.10	341.88	120.12
	U	81.48	130.41	131.88	191.31	372.12	874.65	443.73	539.07	357.00

T — Treated U = Untreated

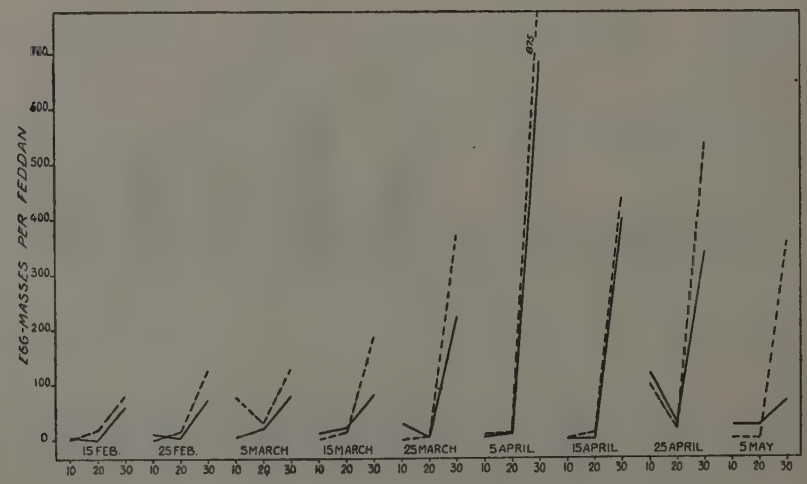


Table and Graph XII.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : GIZA 12.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	21 56	30.38	36.75	39.83	85.95	233.59	133.70	163.94	56.21
U	32.41	48.72	31.38	67.83	126.07	299.32	153.04	218.75	119.00
A	26.98	39.55	34.06	53.83	106.01	261.45	143.37	191.34	87.60

T = Treated U = Untreated A = Average

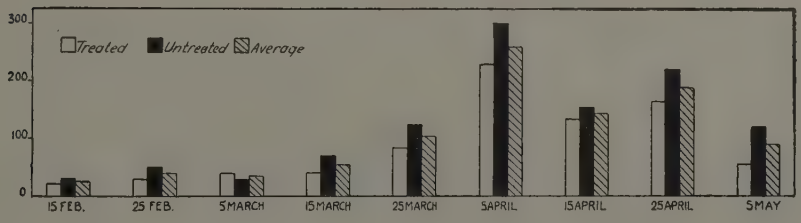


Table and Graph XIII.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : GIZA 19.

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	12.39	11.97	17.01	11.97	18.90	5.88	—	33.18	24.99
	U	—	—	—	—	—	—	11.76	23.73	5.88
20 June	T	—	27.60	28.56	4.62	11.76	15.33	—	4.62	—
	U	10.71	19.53	13.44	13.44	15.33	5.88	5.88	16.59	—
30 June	T	23.73	132.51	65.94	82.11	278.46	489.09	392.70	262.92	225.75
	U	102.27	186.69	78.12	118.65	245.70	395.01	174.93	216.51	134.83

T = Treated U = Untreated

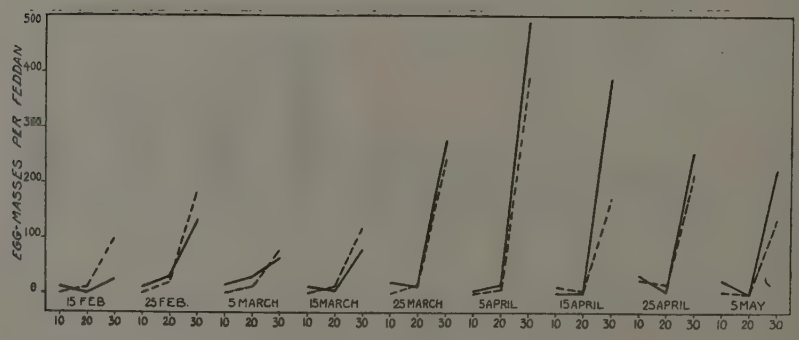


Table and Graph XIV.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : GIZA 19.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	12.04	57.36	37.17	32.90	103.04	170.10	130.90	100 24	83.58
U	37.66	68.70	30.52	44.03	87 01	133.63	64.10	85 61	46 90
A	24.85	63.03	33.84	38.46	95.02	151.86	97.54	92.92	65.24

T = Treated U = Untreated A = Average

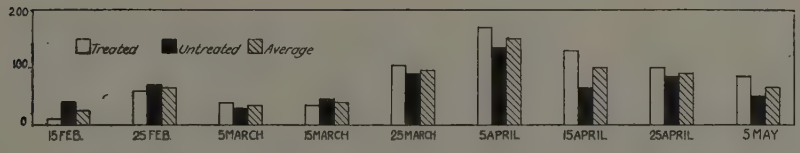


Table and Graph XV.

Average number of egg-masses per feddan in three intervals of June for nine different dates of sowing.

COTTON VARIETY : GIZA 26

DATE	STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	—	28 56	41.58	23.73	110.67	9.45	—	93 87	104.58
	U	16.59	17.85	5.88	11.76	5.88	—	—	96.39	5 88
20 June	T	5.88	22.47	23.73	17.85	53.55	26.04	10 71	23.73	34.44
	U	—	—	48.72	5.88	—	24.99	22.47	10.71	—
30 June	T	53.55	47.46	35 70	139.23	361.62	203.49	222.39	472.29	193.83
	U	40.32	102.27	99.96	272.37	433.02	455.70	187.95	305.76	157 08

T = Treated U = Untreated

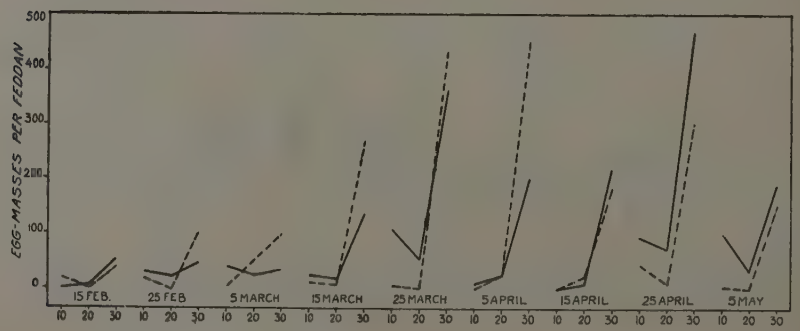


Table and Graph XVI.

Average number of egg-masses per feddan during June for nine different dates of sowing.

COTTON VARIETY : GIZA 26

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	19.81	32.83	33.67	60.27	175.28	79.66	77.70	196.63	110.95
U	18.97	60.06	51.52	96.67	146.30	160.23	70.14	137.62	54.65
A	19.39	46.44	42.59	78.47	160.79	119.94	73.92	167.12	82.80

T = Treated U = Untreated A = Average

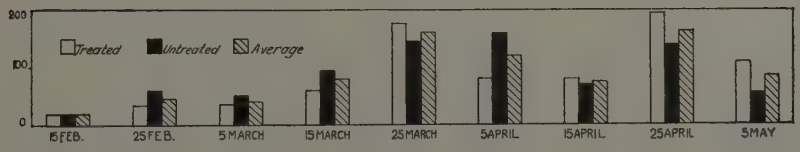


Table and Graph XVII.

Average number of egg-masses per feddan for varieties total average in each of nine different dates of sowing in three intervals of June.

DATE	STATUS	15 FEB.	25 FEB	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
10 June	T	9.11	29.00	34.62	39.92	78.63	18.89	10.05	86.20	51.41
	U	5.17	16.90	26.06	20.68	7.82	9.87	9 31	86.36	17.55
20 June	T	33.32	44 48	35.80	43.50	47.64	14.73	10.94	21.26	14.55
	U	27 88	31.92	40.90	14.80	33.70	14.17	9.97	23.54	1.75
30 June	T	44.80	135.82	70 82	112.24	281 37	429.45	308.46	349.06	208.26
	U	86.57	198.35	121.40	176.10	483.39	601.29	340.14	422.66	238.90

T = Treated U = Untreated

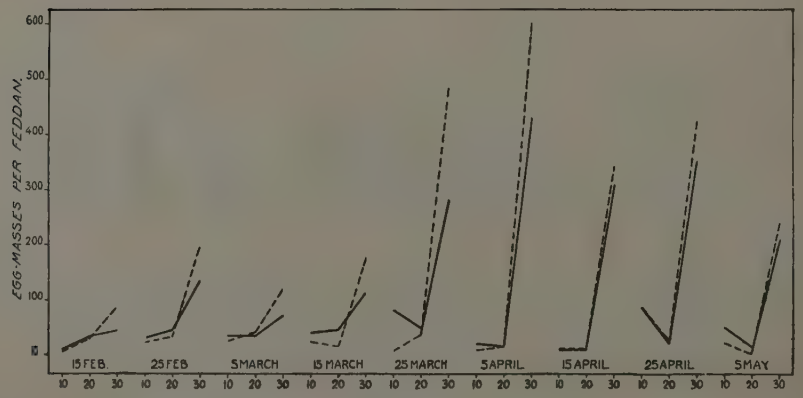


TABLE AND GRAPH XVIII.

Average number of egg-masses per feddan for varieties total average in each of nine different dates of sowing during June.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	29.07	69.76	47.08	65.22	135.88	154.35	109.81	152.17	91.31
U	39.87	82.39	62.78	70.52	174.97	208.44	119.80	177.52	86.00
A	34.47	76.07	54.93	67.82	155.42	181.39	114.80	164.84	88.60

T = Treated U = Untreated A = Average

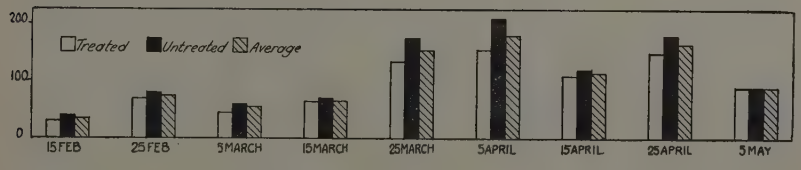


Table and Graph XIX.

Average number of egg-masses per feddan for each variety separately by total average of nine different dates of sowing in three intervals of June.

DATE	STATUS	SAKEL D	SAKEL	SAKHA 4	MAARAD	GIZA 7	GIZA 12	GIZA 19	GIZA 26
10 June	T	73.82	56.01	21.75	43.09	25.33	23.55	15.14	45.82
	U	44.89	27.55	32.08	18.85	11.48	21.32	4.59	17.80
20 June	T	37.35	45.68	17.01	42.29	27.50	13.30	10.27	24.26
	U	37.00	30.13	30.10	32.31	18.87	13.69	11.20	12.30
30 June	T	270.85	254.59	312.58	190.09	166.99	233.12	217.02	192.17
	U	405.82	352.70	215.04	320.99	213.17	346.85	183.63	228.27

T = Treated U = Untreated

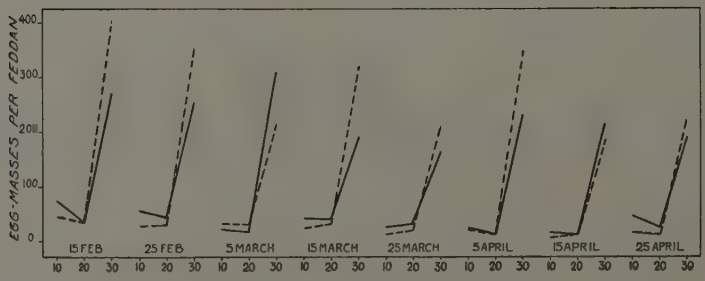


TABLE AND GRAPH XX.

Average number of egg-masses for each variety separately by total average of all different dates of sowing during June.

STATUS	SAKEL D	SAKEL	SAKHA 4	MAARAD	GIZA 7	GIZA 12	GIZA 19	GIZA 26
T	127.34	118.76	120.47	91.82	73.27	99.99	80.81	87.41
U	162.40	136 79	92.60	124 05	81.17	127.28	66.47	86.12
A	144.87	127.77	106.53	107.93	77.22	113.63	73.82	86.76

T = Treated U = Untreated A = Average

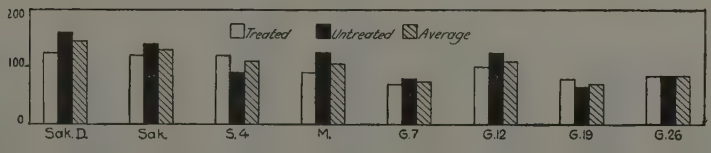


Table and Graph XXI.

Average number of holes per feddan for all varieties in each of nine different dates of sowing.

SECTION	TREATED	COEFFICIENT	UNTREATED	COEFFICIENT	AVERAGE	COEFFICIENT
I	10531.39	2.27	8761.63	2.07	9646 51	2.49
II	14526.27	1.63	9980.11	2.40	12253.19	1.95
III	15043.88	1.59	10732.69	2.23	12888.28	1.86
IV	14377.16	1.66	4517.09	5.31	9447.12	2.54
V	14302.36	1.60	9452.14	2.50	11877.25	2.00
VI	14379.94	1.66	13577.96	1.76	13978.95	1.71
VII	14649.28	1.63	12556.55	1.91	13602.91	1.76
VIII	15105.72	1.58	15012.48	1.55	15059.10	1.59
IX	14174.33	1.66	14009.23	1.71	14091.76	1 73

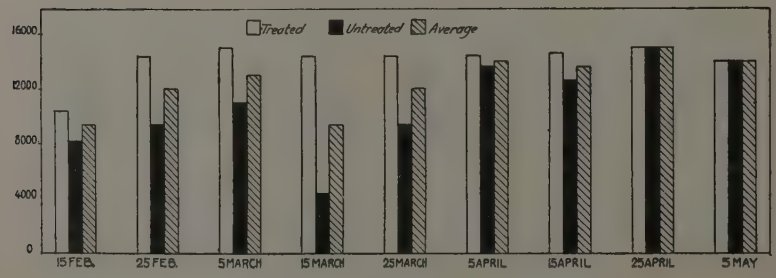


Table and Graph XXII.

Average number of egg-masses per feddan for varieties total average in each of nine different dates of sowing.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	65.99	113.71	74.95	108.27	217.41	256.22	178.99	240.43	151.57
U	82.53	197.73	139.99	374.46	437.43	366.85	228.82	275.16	147.06
A	85.83	148.33	102.16	172 26	310.84	310.18	202.05	262.09	153.28

T = Treated U = Untreated A = Average

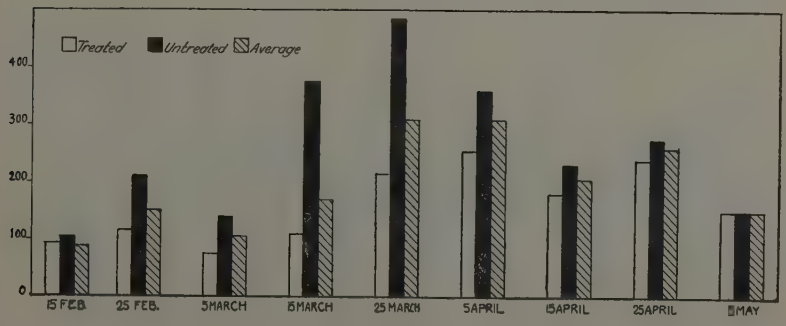


Table and Graph XXIII.

Average number of holes per feddan for each variety separately by total average of all different dates of sowing.

VARIETIES	TREATED	COEFFICIENT	UNTREATED	COEFFICIENT	AVERAGE	COEFFICIENT
SAKEL D	14833.02	1.61	11541.40	2.08	13187.21	1.82
SAKEL	13646.11	1.75	10494.89	2 28	12070.54	1.98
SAKHA 4	13922.67	1.73	11483.81	2.06	12702 74	1.85
MAARAD	13883.84	1.73	9998.31	2.45	11931.07	2.01
GIZA 7	14101.34	1.70	9979.78	2.04	12040.55	1.95
GIZA 12	14649.41	1.63	11507.51	2.08	13078.46	1.82
GIzA 19	13215.95	1.81	10636.48	2.25	11926.21	2.01
GIZA 26	13649.51	1.75	11497.51	2.08	12573.51	1.89

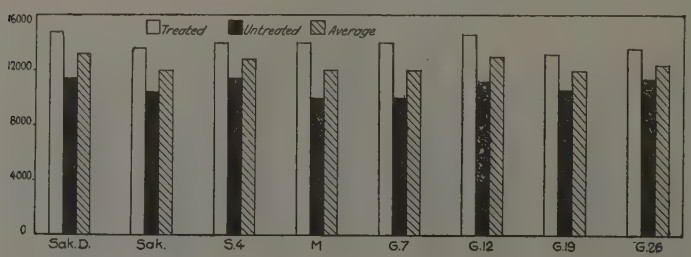


Table and Graph XXIV.

Average number of egg-masses per feddan for each variety separately by total average of all different dates of sowing.

STATUS	SAKEL D	SAKEL	SAKHA 4	MAARAD	GIZA 7	GIZA 12	GIZA 19	GIZA 26
T	205.02	207.83	208.41	158 85	124.56	162.98	146 27	152.97
U	337.79	311.88	190.76	303.92	165.59	264.74	149.56	179.13
A	263.66	252.98	197 08	216.94	150.58	206.81	147.37	163 98

T = Treated U = Untreated A = Average

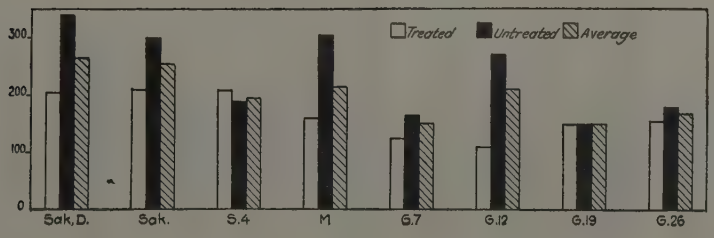


Table and Graph XXV.

Average number of plants per feddan
for varieties total average in each of nine different dates of sowing.

SECTION	TREATED	COEFFICIENT	UNTREATED	COEFFICIENT	AVERAGE	COEFFICIENT
I	20132.51	2.38	17902.96	2.67	19017.74	2.52
II	26894.19	1.78	18542.84	2.50	22718.52	2.11
III	29231.17	1.20	18975.28	2.53	24103.23	1.87
IV	27645.43	1.73	7828.58	6.13	17737.05	2.70
V	25905.36	1.85	15797.95	3.03	20851.65	2.30
VI	25145.41	1.91	23232.27	2.06	24188.84	1.98
VII	26627.29	1 81	22301.87	2.15	24465.03	1.96
VIII	25468.48	1.88	26267.29	1.82	25867.88	1.85
IX	25460.37	1.88	25177.98	1.90	25319.17	1.88

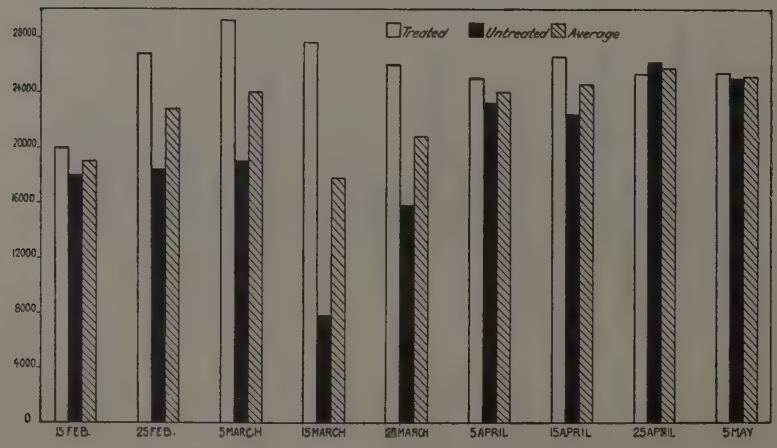


Table and Graph XXVI.

Average number of egg-masses per feddan for varieties total average in each of nine dates of sowing.

STATUS	15 FEB.	25 FEB.	5 MARCH	15 MARCH	25 MARCH	5 APRIL	15 APRIL	25 APRIL	5 MAY
T	69.19	124.17	56.49	112.83	251.38	294.81	198.76	286.08	171.66
U	106.15	205.97	158.80	432.29	530.16	429.39	257.57	323.09	163.40
A	86.86	160.48	102.71	183.11	357.47	359.15	225.01	304.95	167.45

T = Treated U = Untreated A = Average

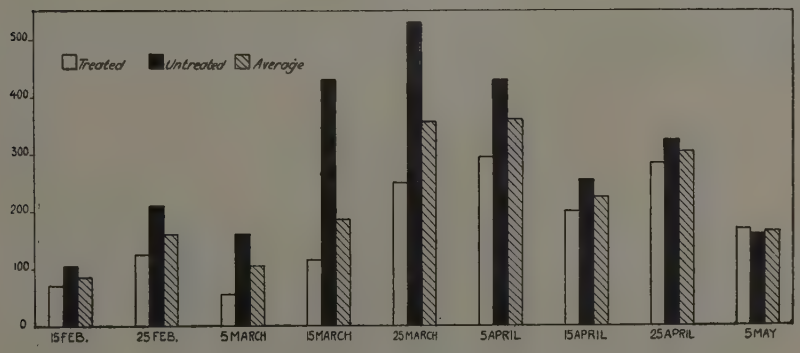


Table and Graph XXVII.

Average number of plants per feddan for each variety separately by total average of all different dates of sowing.

VARIETIES	TREATED	COEFFICIENT	UNTREATED	COEFFICIENT	AVERAGE	COEFFICIENT
SAKEL D	26776.10	1.70	21544.11	2.22	24160.09	1.98
SAKEL	23761.10	2.02	17747.59	2.69	20754.34	2.31
SAKHA 4	25773.45	1.87	19849.08	2.42	22811.26	2.14
MAARAD	26196.21	1.82	18724.44	2.56	22460.32	2.18
GIZA 7	27607.76	1.73	19336.78	2.48	23473.77	2.08
GIZA 12	25865.32	1.85	19773.56	2.42	22819.44	2.10
GIZA 19	24506.68	1.96	19679.42	2.44	22093.05	2.17
GIZA 26	26414 33	2.23	20798.10	2.31	23611.21	2.03

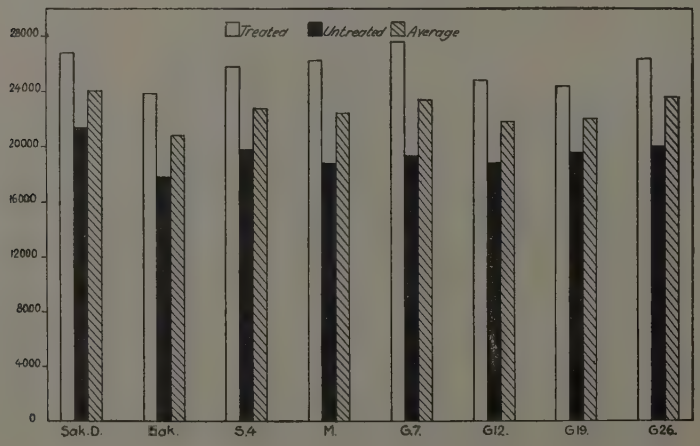
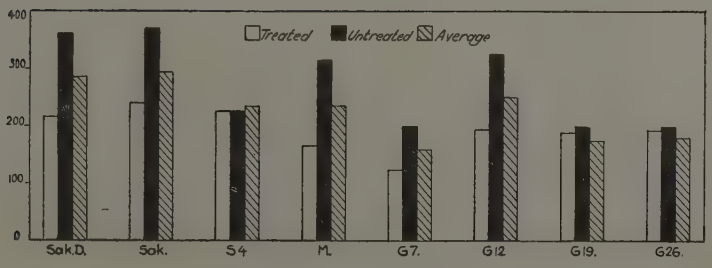


Table and Graph XXVIII.

Average number of egg-masses per feddan for each variety separately by total average of all different dates of sowing.

STATUS	SAKEL D	SAKEL	SAKHA 4	MAARAD	GIZA 7	GIZA 12	GIZA 19	GIZA 26
T	216.48	239.89	225.28	167.11	126.76	184.98	193.17	194.92
U	360.53	367.97	224.09	317.57	201.30	307.02	1' 8.93	198.94
A	286.84	295.15	227.97	235.29	160.62	238.62	176 12	176.12

T = Treated U = Untreated A = Average



Nouvelle contribution à l'étude des Buprestides d'Egypte

par André Théry,

attaché au Museum National d'Histoire Naturelle, Paris.

Mon ami Monsieur A. Alfieri m'a confié, à nouveau, l'étude de quelques Buprestides égyptiens ; leur examen confirme les relations existant entre les faunes égyptienne et algérienne.

Genre Acmaeodera Eschsch.

Acmaeodera octodecimguttata ssp. acaciae Mayet.

Cette espèce, qui vit sur les gommiers (*Acacia tortilis* Willd.), a été obtenue d'éclosion, le 9.V.1937, de brindilles de bois provenant de Wadi Feiran (Sinaï) et récoltées par Monsieur A. Rabinovitch deux ans auparavant. L'exemplaire du Sinaï ne diffère en rien de certains exemplaires du Bled Thala (Tunisie), patrie du type. Cette espèce, qui paraît spéciale à l'*Acacia tortilis* ou au moins aux *Acacia*, peut être maintenant considérée comme habitant tout le nord de l'Afrique.

Acmaeodera convoluta Klug.

Je n'ai pas vu le type de Klug, mais l'examen de la figure et de la description de cette espèce font ressortir clairement qu'elle ne diffère seulement de *flavipennis*, du même auteur, que par des détails de coloration. Klug lui-même, en parlant de cette dernière, signale qu'elle ressemble beaucoup à *convoluta ;* et les deux espèces ayant été capturées dans la même localité, je n'hésite donc pas à considérer *flavipennis* à élytres sans taches et à pronotum bordé latéralement de jaune comme une aberration de *convoluta*, car on ne saurait utilement multiplier les noms de ces diverses aberrations qui peuvent être divisées ainsi :

A. — Pronotum sans taches latérales, élytres avec des dessins réguliers d'un brun noirâtre ..... *convoluta* (Type)

B. — Pronotum sans taches latérales, élytres couverts de dessins vermiculés très nets et plus irréguliers.

C. — Pronotum avec une tache jaune dans les angles postérieurs, élytres avec quelques taches brunâtres et mal limitées, sur la partie postérieure.

D. — Pronotum bordé de jaune, élytres sans taches .... *flavipennis* (Type)

Il existe des formes intermédiaires entre ces diverses variations, l'appa-

rition d'une tache sur les côtés du pronotum correspondant toujours à une diminution de la couleur foncée des élytres. L'espèce vit sur *Acacia tortilis*.

Genre Sphenoptera Sol.

Sphenoptera brevior Pic.

Cette espèce a été capturée en trois exemplaires, à l'entrée du Jourdain dans la Mer Morte, à Pont Allenby, Palestine, par Monsieur A. Rabinovitch, sur *Tamarix* de grande taille. L'espèce, décrite d'après un exemplaire capturé à Lambessa (Algérie) par Monsieur Pic, est encore très rare dans les collections. Elle a été reprise à Agadir (*smaragdifrons* Esc.), dans le Grand Atlas, Haute Reraya (P. de Peyerimhoff), à Charrier (province d'Oran) et en Tunisie par Dumont. Je pense qu'elle doit se trouver en Egypte.

Genre Anthaxia Eschsch.

Anthaxia congregata Klug.

Monsieur Rabinovitch a obtenu, par éclosion de larves vivant dans le bois de l'*Acacia tortilis*, un certain nombre d'*Anthaxia* répondant à la forme *Kneuckeri* Obb. d'*Anthaxia congregata* Klug. Malgré un examen des plus minutieux des caractères externes, je ne trouve rien qui me permette de considérer *Kneuckeri* comme espèce autonome. Les exemplaires examinés sont tous de petite taille et rougeâtres et c'est leur seule différence avec *congregata* Klug. Ils proviennent de Sohna (Mer Rouge) et de Wadi Feïran (Sinai), et éclos un an après la récolte des bois. Faut-il voir là la raison de leur petite taille ? Il me paraît plus probable qu'il existe dans certaines localités des exemplaires plus grands que dans d'autres, comme cela a lieu pour *Sphenoptera rauca* F.

Anthaxia Sedilloti ssp. Rabinovitchi nov. (Fig. 1).

Anthaxia Sedilloti n'a pas encore été signalée d'Egypte. Monsieur Alfieri m'en a communiqué trois exemplaires provenant du Wadi Digla et obtenus le 6.III.1935 de branches de *Retama* rapportées par Monsieur Rabinovitch. Ces exemplaires diffèrent nettement de la forme type décrite d'Algérie et de Tunisie. Ils forment une sous-espèce bien caractérisée, mais je n'ai pas cru pouvoir les considérer comme spécifiquement distincts. J'ai examiné un mâle d'*Anthaxia Sedilloti* et un autre de sa sous-espèce *Rabinovitchi*. Le premier a une longueur de 4 mm. 6, le second ne l'a que de 4 mm. 5. Je les ai mesurés avec un grossissement de × 20. Pour le comparer plus facilement, j'ai ramené les mesures de *Anthaxia Sedilloti* à la longueur trouvée par sa sous-espèce et je suis arrivé aux chiffres suivants :

	Sedilloti	ssp. *Rabinovitchi*
Longueur totale	9,10	9.10
Largeur de la tête	2,25	2,42
Largeur du pronotum au milieu ...	3,00	2,97
Largeur du pronotum à la base ...	2.60	2,61

De l'examen de ces mesures, il résulte que la ssp. *Rabinovitchi* a une tête moins large, un pronotum un peu plus étroit, ce qui contribue à faire paraître la tête encore plus large ; quant à la largeur à la base, elle est sensiblement la même. A ces caractères il faut ajouter les suivants : Tête légèrement bombée en avant, chez *Rabinovitchi*, et légèrement impressionnée en avant, chez *Sedilloti*. Ecusson plus grand et nettement plan, chez *Rabinovitchi*. Je n'ai trouvé aucune différence dans les genitalia.

Fig. 1.

Anthaxia Sedilloti
ssp. *Rabinovitchi* nov.

Anthaxia Sedilloti et sa sous-espèce se rattachent très nettement à *Anthaxia funerula* Ill. et surtout à sa variété *mamorensis* Théry, dont les côtés du prothorax sont anguleusement sinués avant la base. *Anthaxia funerula* se distingue par une forme moins élancée et la présence d'une grosse ponctuation à l'apex, mais cette ponctuation se retrouve, très affaiblie, chez *Sedilloti*.

Anthaxia Patrizii nov.spec. (Fig. 2).

Longueur 9 mm. ; largeur 3.25 mm., mâle. — Assez large, d'un bronzé légèrement pourpré en dessus, dessous plus cuivreux.

Tête large, front entièrement recouvert d'une longue pubescence blanche, serrée, uniforme et remplie d'une poussière blanche qui cache complètement la sculpture du front, cette pubescence, vue de dessus, fait paraître le front plus bombé qu'il ne l'est en réalité. Vertex assez fortement et densément ponctué, sub-réticulé ; partie du front située entre les yeux, plus haute que large, ses côtés convergents fortement dans le haut, et très faiblement divergents, en ligne droite, vers le bas, à partir du milieu. Epistome large, subanguleusement échancré. Yeux grands, occupant toute la hauteur de la tête, assez rapprochés sur le vertex. Antennes grêles, n'atteignant pas la base du

pronotum, dentées à partir du quatrième article, le deuxième et le troisième presqu'égaux, les articles dentés assez transversaux.

Pronotum ayant sa plus grande largeur vers le milieu, plus rétréci en avant qu'en arrière, arrondi sur les côtés, fortement bisinué et rebordé en avant, avec le lobe médian arrondi, les côtés rebordés par une très fine carène sinueuse bien distincte sur les trois quarts postérieurs de la longueur ; les angles postérieurs faiblement obtus, avec une très petite dent au sommet. Base droite de chaque côté et arquée au milieu. Disque uniformément, mais assez faiblement bombé, avec, de chaque côté, une large impression superficielle, située vers les angles postérieurs, à égale distance des côtés et de la base. Milieu du disque couvert de très fines rides très serrées et peu marquées, tombant perpendiculairement sur des rides latérales, plus distinctes, et laissant, dans les angles postérieurs, un espace régulièrement et assez fortement réticulé, chaque maille de la réticulation munie d'un point central ; le disque est glabre ou à peine distinctement pubescent, les côtés sont recouverts de quelques poils blonds. Base du pronotum bordée d'un étroit bandeau très lisse et brillant.

Fig. 2.

Anthaxia Patrizii nov. spec.

Ecusson cordiforme, assez grand.

Elytres ayant, à la base, la même largeur que la base du pronotum, exception faite pour une petite saillie latérale formée par le prolongement du rebord basal ; ayant aux épaules la même largeur que le pronotum au milieu, rétrécis ensuite faiblement et presqu'en ligne droite, jusqu'après le milieu, puis atténués en faible courbe, jusqu'au sommet, où ils sont isolément et étroitement arrondis, fortement denticulés, la denticulation plus fine et beaucoup plus serrée à l'apex. Carènes épipleurales très nettes, entières, se réunissant aux épaules avec le rebord basal, se continuant en arrière un peu en gouttière, jusqu'à l'apex. Un peu après le milieu, la carène épipleurale s'ap-

platit et devient fortement denticulée, elle est alors surmontée d'un fort sillon et forme une gouttière assez profonde. Calus huméral assez saillant, surmonté d'un bourrelet oblique. Base des élytres avec un bourrelet, de chaque côté, allant de l'écusson au milieu de l'élytre et se continuant, le long du bord basal par un bourrelet beaucoup plus fin qui fait saillie à l'angle huméral. Suture tectiforme postérieurement, un peu enfoncée en avant sur le quart antérieur, avec, de chaque côté, un renflement du disque en forme de bosse. Toute la surface du disque est très finement granuleuse, sans ponctuation ni pubescence distinctes.

Dessous abondamment recouvert d'une pubescence roussâtre, couchée, voilant presque complètement le fond. Prolongement latéral de l'abdomen large. Bord postérieur des hanches postérieures armé d'une forte dent située non loin de son bord externe. Pattes robustes, tibias antérieurs et intermédiaires arqués, les postérieurs droits, un peu élargis au sommet et frangés vers le sommet de poils obliques, assez serrés.

Tarses postérieurs ayant environ les trois quarts de la longueur des tibias.

Genitalia très chitinisés, presque noirs, les paramères très renflés à la base et affectant la forme d'une pince de Forficule. Pénis très étroit et effilé.

Eclos en juin 1937, de fragments de bois d'*Acacia tortilis*, provenant de Sohna, sur les bords de la Mer Rouge (A. Rabinovitch). Un paratype se trouve dans ma collection, il paraît être du même sexe, mais est un peu plus petit.

Cette espèce rappelle un peu le genre *Chalcogenia* par ses élytres fortement denticulées et sa forme large, mais chez ce genre, le pronotum ne porte jamais de traces de réticulation. Elle pourrait se confondre avec *Anthaxia congregata*, avec laquelle elle habite peut-être, mais elle s'en distingue facilement par sa forme plus large, son front uni et uniformément pubescent, sans impression finement ponctuée au sommet, par les bords antérieurs des yeux à peine divergents dans le bas et par la denticulation beaucoup plus forte des élytres. Les yeux sont aussi beaucoup plus rapprochés chez *Anthaxia Patrizii* nov.

	A. congregata	*A. Patrizii*
Largeur de la tête	2 mm. 4	2 mm. 4
Distance entre les yeux sur le vertex. ...	1 mm. 1	0 mm. 9

A List of Orthoptera from South Arabia

(with 4 Text-Figures)

by B.P. Uvarov and Mohammed Tewfik.

The present list is based on material collected from Yemen and Hadramut (South Arabia), between April and October 1936, by Mohammed Tewfik Effendi, assistant entomologist, Faculty of Science, and member of the Egyptian University Expedition, and was determined by him and the senior author at the British Museum (Natural History).

The results of this study proved to be of considerable interest owing to the discovery of four new species of *Acrididae* (Sub-families : *Pyrgomorphinae* and *Catantopinae*) whose descriptions are given below. Some doubtful species are left without definite determination until more material is available. This collection contributes considerably towards our knowledge of the Fauna of South Arabia as regards the geographical distribution of the genera and species, as well as their occurrence at various altitudes. Short notes of biological interest for certain species are also recorded.

Gryllidae

Oecanthus spec.

Hadramut : Ghail Ba-Wazir, 16.X.36, altitude 140 metres, 1 nymph.

Tettigoniidae

Conocephalus spec.

Hadramut : Ghail Ba-Wazir, 16.X.36, altitude 140 metres, 2 nymphs on *Medicago sativa* L.

Phaneroptera nana Fieber 1853.

Yemen : Hizran, 28.IV.36, altitude 1200 metres, 1 ♀ in cultivated area ; Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♀.

Eurycorypha arabica Uvarov 1936.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂.

Appears to belong to a sub-species very close to *E. arabica arabica*, but more material would be necessary for sub-specific determination.

Trigonocorypha spec.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♀.

Appears to be very close to *T. abnormis* Br. W., but the genus is very imperfectly known and exact determination from a single female impossible. The genus is Indian and new to Arabia.

Acrididae

Acridinae

Acrida curta Uvarov 1936.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 2 ♂♂ and 1 ♀.

Hadramut : Wadi Gethmeh (Seyoun), 28.IX.36, altitude 570 metres, 4 nymphs; Ghail Ba-Wazir, 16.X.36, altitude 140 metres, 2 nymphs, on *Medicago sativa* L.

Acridella arabica Uvarov 1933.

Hadramut : Horeida, 2.X.36, altitude 710 metres, 1 ♂.

Duronia tricolor Karny 1907.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♀.

Platypterna judaica Salfi 1931.

Aden : Lahj, 19.IV.36, altitude 140 metres, 1 ♂, on *Medicago sativa* L.

Platypterna kraussi I. Bolivar 1913.

Aden : Lahj, 19.IV.36, altitude 140 metres, 2 ♀♀, on *Medicago sativa* L.

Platypterna obsoleta Uvarov 1936.

Yemen : Wadi Sheira, 24.VI.36, altitude 1980 metres, 1 ♂.

Platypterna spec.

Yemen : Wadi Nakhla (Heiss), 9.V.36, altitude 220 metres, 1 ♂.

Platypternella pictifemur Salfi 1928.

Aden : Lahj, 19.IV.36, altitude 140 metres, 4 ♂♂ and 2 ♀♀. Described from Obock, French Somaliland.

Stenohippus spec.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 2 ♀♀.

More material of both sexes would be needed for specific determination.

Paracinema tricolor Thunberg 1815.

Yemen : Hizran, 28.IV.36, altitude 1200 metres, 1 ♀ in cultivated area.

It would be unsafe to attempt determining the sub-species from a single female. The genus is new to Arabia.

Aiolopus affinis I. Bolivar 1902.

Yemen : Wadi Nakhla (Heiss), 9.V.36, altitude 220 metres, 1 ♂; Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂ and 2 ♀♀.

Aiolopus thalassinus Fabricius 1781.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 2 ♂♂.

Hadramut : El-Shihr (Gulf of Aden), 4.IX.36, 1 ♀.

Oedaleus obtusangulus Uvarov 1936.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♀.

Previously known only from one female in the British Museum (Natural History) collection.

Oedaleus senegalensis Krauss 1877.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂.

Mesopsis alienus Uvarov 1936.
Yemen : Wadi Sheira, 24.VI.36, altitude 1980 metres, 1 ♂.

Oedipodinae

Sphingonotus arabicus Mistchenko 1936.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂.

Sphingonotus canariensis Saussure 1884.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 8 ♂♂ and 10 ♀♀.

Sphingonotus femoralis Uvarov 1933.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 4 ♀♀,

Sphingonotus rubescens Walker 1870.
Yemen : Wadi Sheira, 24.VI.36, altitude 1980 metres, 3 ♂♂.
Hadramut : Terim, 12-20.IX.36, altitude 650 metres, 1 ♂ and 2 ♀♀ ; Sheb Hud, 22.IX.36, altitude 460 metres, 1 ♂ and 1 ♀.

Pycnodictya dentata Krauss 1902.
Yemen : Wadi Sheira, 24.VI.36, altitude 1980 metres, 1 ♀.

Scintharista notabilis brunneri Saussure 1884.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂ with its hind wings red, and 2 ♀♀ with yellow ones.

Acrotylus insubricus inficitus Walker 1870.
Aden : Lahj, 19.IV.36, altitude 140 metres, 1 ♀, on *Medicago sativa* L.

Acrotylus longipes Charpentier 1845.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 3 ♀♀.

Acrotylus variegatus Brancsik 1893.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂ and 1 ♀.

Trilophidia spec.
Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂.

Pyrgomorphinae

Tenuitarsus spec.
Hadramut : Horeida, 2.X.36, altitude 710 metres, 1 ♀.

Poecilocerus vittatus Klug 1832.

Yemen : Hizran, 28.IV.36, altitude 1200 metres, 1 nymph in cultivated area ; Gebel El-Showar (Beni Yousif) « Hugariya », 2.V.36, altitude about 1800 metres, 1 ♂ ; Wadi Nakhla (Heiss), 9.V.36, altitude 220 metres, 1 ♂ and 1 ♀ ; Wadi Sheira, 24.VI.36, altitude 1980 metres, 1 ♀.

Hadramut : Wadi Gethmeh (Seyoun), 28.IX.36, altitude 570 metres, 1 ♀.

Poecilocerus arabicus Uvarov 1922.

Yemen : Wadi Hidjan, 8.VIII.36, altitude 710 metres, 1 ♂.

Parasphena tewfiki nov. spec.

Yemen : Top of Gebel El-Nabi Shoeib, 16.VI.36, altitude 3525 metres, 4 ♂♂, 4 ♀♀ and 2 nymphs. The temperature was 16° C. between 9-10 a.m. and the sky clear but windy. Flora on top consisted mostly of *Marrubium*, *Thymus* and *Malva* spp. ; Wadi El-Qaria (Gebel El-Nabi Shoeib), 16.VI.36, altitude 2860 metres, 1 ♂ and 4 ♀♀, on *Medicago sativa* L.

(See description given below).

Parasphena spec.

Yemen : Taïz, 21-28.IV.36, altitude 1300 metres, 1 ♂.

(See notes given below).

Pyrgomorpha cognata Krauss 1877.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂.

Hadramut : Ghail Ba-Wazir, 16.X.36, altitude 140 metres, 1 ♂.

Pyrgomorpha hemiptera nov. spec.

Yemen : Taïz, 21-28.IV.36, altitude 1300 metres, 1 ♂.

(See description given below).

Pyrgomorpha spec.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♀.

Atractomorpha brevis nov. spec.

Yemen : Hizran, 28.IV.36, altitude 1200 metres, 1 ♀ in cultivated area ; Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂.

(See description given below).

Catantopinae

Asmara glabra nov. spec.

Yemen : Top of Gebel El-Nabi Shoeib, 16.VI.36, altitude 3525 metres, 1 ♂ and 3 ♀♀. The temperature was 16° C. between 9-10 a.m. and the sky clear but windy. Flora on top consisted mostly of *Marrubium*, *Thymus* and *Malva* spp.

(See description given below).

Cataloïpus spec.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 1 ♂. It would be unwise to determine a species of this difficult genus from a single male.

Caloptenopsis glaucopsis Walker 1870.

Yemen : Hizran, 28.IV.36, altitude 1200 metres, 1 ♂ in cultivated area. More material is necessary to determine the sub-species.

Catantops saucius Burmeister 1838.

Yemen : Wadi Sharis, 16-21.VII.36, altitude 1080 metres, 2 ♀♀.

Anacridium moestum melanorhodon Walker 1870.

Yemen : Wadi Nakhla (Heiss), 9.V.36, altitude 220 metres, 1 ♀.

Acanthacris ruficornis yemenita Uvarov 1936.

Yemen : Top (El-Arus) of Gebel Sabir « Taiz », 26.IV.36, altitude 3075 metres, 1 ♂ and 1 ♀. The temperature was 17° C. at 3 p.m., sky cloudy and the wind strong. Flora on top consisted mostly of *Mentha*, *Ruta*, *Gladiolus* and *Ocimum* spp. Crops cultivated near the top were *Triticum*, *Hordeum*, *Ipomoea* spp. and *Solanum lycopersicum* L.

DESCRIPTION OF FOUR NEW SPECIES

by Dr. B. P. Uvarov.

Parasphena tewfiki nov. spec.

(Fig 1 : A, B, C)

Closely allied to *P. yemenita* Uvarov 1936, but differs from it in shorter antennae, more robust body and the sculpture of the integument, which is more smooth generally and covered mostly by wrinkles, not callous tubercles.

Male : Antennae stout, distinctly shorter than head and pronotum together, composed of definitely transverse joints, except the apical joint (in *P. yemenita* practically all joints are distinctly longer than broad).

Face strongly oblique. Frontal ridge weakly prominent between antennae, narrowly sulcate throughout except quite close to the clypeus where the sulcus is obsolete. Fastigium of vertex parabolic, a little longer than broad. Vertex and occiput rugulose, with a low continuous carinula. Cheeks with an oblique series of large callosities.

Pronotum densely, but not deeply, punctured ; raised intervals between punctures callous, particularly in metazona. Median carina indicated by a low smooth line, very finely sulcate in places. Lateral carinae very faintly indicated, rather approximate and somewhat incurved in prozona, more widely distant and sub-convex in metazona. Metazona about one third the length of the whole pronotum. Posterior margin very shallowly excised ; margins of the excision convex. Lateral lobe longer than high, punctured and rugulose,

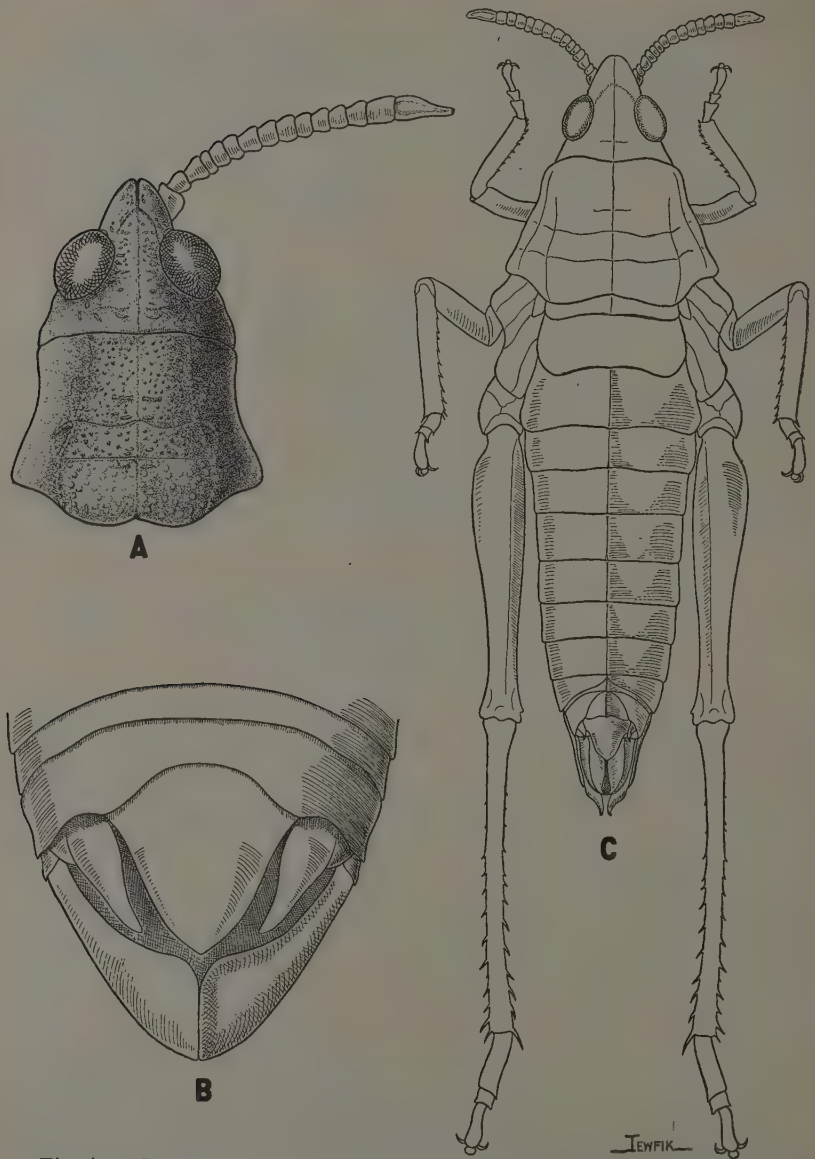


Fig. 1. — *Parasphena tewfiki* nov. spec. : A. Head and pronotum of male (dorsal view); B. End of the male abdomen (dorsal view); C. Adult female (dorsal view).

more so in metazona ; above with two oblong, practically smooth depressions ; lower margin sinuate, broadly callous. Mesonotum, metanotum and the middle of the first abdominal tergite smooth (covered by callous tubercles throughout in *P. yemenita*).

Sides of the first abdominal tergite, and the whole following tergites covered by not dense and very low callosities. Last tergite with a parabolic emargination which is as broad as the base of supra-anal plate (in *P. yemenita* the emargination is distinctly less broad than the base of the plate). Supra-anal plate acutely triangular (less acute than in *P. yemenita)*, longer than broad, smooth. Cerci practically as long as supra-anal plate, narrowly triangular, somewhat compressed laterally, with the apex distinctly decurved.

General colouration dark brown, with the callosities pale buff. Antennae underneath brown ; above brown, with incomplete pale rings. Hind femur underneath and hind tibia testaceous.

Female : Body robust, depressed.

Antennae much shorter than head and pronotum, all joints strongly transverse. Metazona of pronotum with well pronounced shoulders, the lateral lobes forming a right angle with the disc. Abdominal tergites practically smooth. General colouration pale yellowish-green, with a narrow yellowish median stripe along the dorsum, surrounded on the abdomen by faint broad dark stripes ; sides of abdominal tergites with a series of brown spots. Front and middle legs and the hind tibia yellowish.

Length of body ♂ 18, ♀ 23 ; pronotum ♂ 3.7, ♀ 4.5 ; hind femur ♂ 9.5, ♀ 10.5 mm.

Yemen : Top of Gebel El-Nabi Shoeib, 16.VI.36, 4 ♂♂ (including the Type), 4 ♀♀ and 2 nymphs ; Wadi El-Qaria, Gebel El-Nabi Shoeib, 16.VI.36, 1 ♂ and 4 ♀♀.

The male and the female described above represent two extreme colour forms, and both sexes can be either green, or brown. In some green specimens, traces of reddish colour are observed on the pronotum. The pale median stripe on the dorsum is usually absent.

Parasphena spec.

Yemen : Taïz, 21-28.IV.36, 1 ♂ and 1 nymph.

The single adult male from Taïz differs from *P. tewfiki* by more densely punctured body, there being no smooth surfaces on mesonotum, metanotum and first abdominal tergite. In these respects the specimen appears nearer to *P. yemenita* (described from Sanâ), but in all other characters it is distinctly close to *P. tewfiki*. More material is necessary to decide whether this is a new species, or a local form of *P. tewfiki*.

Pyrgomorpha hemiptera nov. spec.

(Fig. 2 : A and B)

A small and slender species with the elytra very strongly abbreviated, but not lateral as in *Pyrgomorphella*.

Male : Antennae stout, distinctly shorter than head and pronotum, all joints shorter than broad.

Face very strongly oblique, sinuate. Frontal ridge strongly compressed between antennae; below them depressed and practically obsolete. Fastigium of vertex distinctly longer than broad, with semi-circular apex and parallel margins. Vertex and occiput with a distinct median carinula.

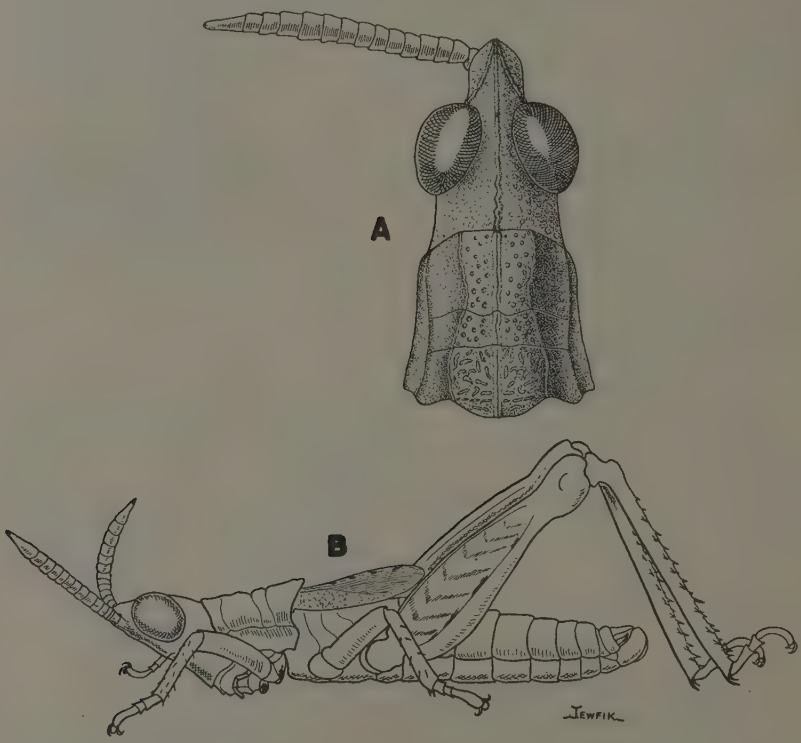


Fig. 2. — *Pyrgomorpha hemiptera* nov. spec. : A. Head and pronotum of male (dorsal view); B. Adult male (lateral view).

Pronotum rugulose. Median carina strongly raised, particularly in front of the second sulcus and in metazona. Lateral carinae distinct, somewhat inflexed in prozona, more widely distant and parallel in metazona, which is one third the length of the whole pronotum and rounded behind. First trans-

verse sulcus practically obsolete on the disc, not cutting the median carina; second sulcus very deep, parallel to the third which is also very deep. Lateral lobe much longer than deep, rugulose, with an oblique series of tubercles above the middle of the prozona; lower margin moderately sinuate; posterior angle slightly attenuate, obtuse.

Prosternum with an obtuse, low conical tubercle. Mesosternal lobes much longer than wide, the interspace narrower than a lobe, narrowed behind. Metasternal lobes contiguous.

Elytra oval, reaching the middle of second tergite. Wings half the length of elytra.

Hind femur relatively short and stout. Hind tibia without the apical external spine.

Last tergite with a rather deep semi-circular excision, which is almost as broad as the base of supra-anal plate. Supra-anal plate acutely triangular, weakly convex. Cercus rather stout, acutely triangular. Sub-genital plate large, laterally compressed, viewed in profile rounded-truncate, below with two carinulae convergent to the apex.

General colouration brown, mottled with blackish and with the usual pale lower border of pronotal lobes.

Length of body 11; pronotum 2.2; elytra 3; hind femur 6 mm.

Yemen : Taïz, 21-28.IV.36, 1 ♂ (Type).

This little *Pyrgomorpha* is comparable only to certain brachypterous species of Morocco, but is much smaller than any of them.

Atractomorpha brevis nov. spec.

(Fig. 3 : A and B)

Very similar to the African *A. gerstaeckeri* I. Bolivar 1884, but differing from it by the distinctly shorter fastigium of vertex and shorter elytra (particularly in the female sex).

Male : Antennae reaching only the metazona of pronotum, stout, somewhat flattened.

Face covered with scattered round tubercles. Frontal ridge strongly laminate at the fastigium, slightly expanded above the antennae and strongly constricted between their bases; between antennae and ocellum weak, but distinct, with a shallow sulcus and definitely raised continuous margins; below the ocellum practically obsolete. Fastigium of vertex seen in profile about as long as the eye; seen from above it is parabolic, with practically straight divergent sides. Head above with scattered round tubercles.

Pronotum distinctly narrowed forward, with scattered tubercles. Median carina fine. Lateral carinae scarcely perceptible, slightly inflexed in prozona. First transverse sulcus practically obsolete; the second well distinct, placed in front of the middle; the third weaker than second, behind the middle.

Lateral lobe with the lower margin very weakly sinuate ; posterior angle acute ; posterior margin broadly rounded excised.

Prosternal tubercle transversely laminate, with the apex truncate. Mesosternal lobe and the interspace longer than wide.

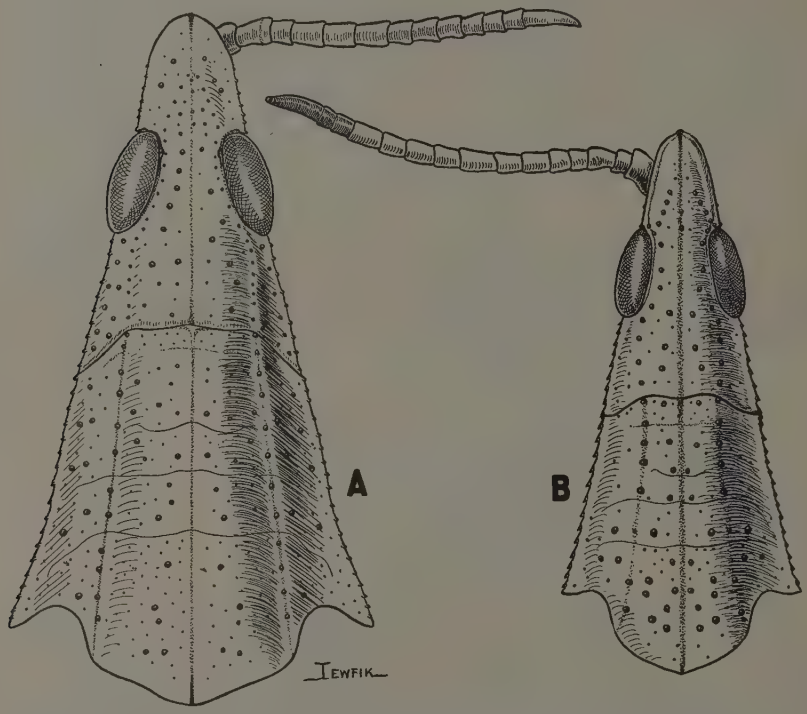


Fig. 3. — *Atractomorpha brevis* nov. spec.: A. Head and pronotum of female (dorsal view); B. Head and pronotum of male (dorsal view).

Elytra extending beyond hind knees, less pointed than in *A. gerstaeckeri*.

Colouration light-green. Abdomen above, and base of hind wings pink.

Female : Antennae very short, reaching only the second sulcus of pronotum. Frontal ridge below ocellum weak but perceptible. Mesosternal lobe about as long as wide ; the interspace transverse. Elytra extending very little beyond hind knees.

Length of body ♂ 19, ♀ 29 ; head ♂ 4, ♀ 5.5 ; pronotum ♂ 4.5, ♀ 6.5 ; elytra ♂ 17, ♀ 21 ; hind femur ♂ 9.5, ♀ 13 mm.

Yemen : Wadi Sharis, 16-21.VII.36, 1 ♂ (Type) ; Hizran, 28.IV.36, 1 ♀.

Type in the Egyptian University, Faculty of Science (Cairo), paratype in the British Museum (Natural History).

The differences of this insect from *A. gerstaeckeri* are admittedly relative and may be only sub-specific, but this can be decided only when a longer series will be available for study.

The genus *Atractomorpha* has not been recorded from Arabia before.

Asmara glabra nov. spec.

(Fig. 4 : A and B)

Differs from *A. punctata* Uvarov 1936 by shorter antennae, head and pronotum; by less divergent lateral pronotal carinae; by the mesonotum, metanotum and first abdominal tergite not punctured; and by shorter hind femur which is coloured red on the underside.

Male : Antennae shorter than head and pronotum together, very stout, widened in the middle, composed mainly of transverse joints.

Face moderately oblique, weakly convex in profile. Frontal ridge between antennae weakly expanded and somewhat concave; below the ocellum (which is poorly developed) flat; surface with a few very fine punctures. Fastigium of vertex short, sloping, weakly convex, with an obtuse median carinula which becomes obsolete between the eyes.

Pronotum relatively short, not narrowed forward, very slightly constricted. Disc obtusely tectiform, practically smooth in prozona, and with a few very shallow, obsolescent, punctures in metazona, which is shorter than one third of the length of whole pronotum. Median carina tectiform, thick, smooth, very finely sulcate in places; seen in profile distinctly gibbose. Lateral carinae thick, smooth, in the prozona practically parallel and very slightly incurved; in metazona a little more widely distant, parallel. Front margin of the disc broadly rounded; hind margin obtusely excised, with the sides of the excision broadly rounded. Lateral lobe shiny, with punctures both in prozona and in metazona not dense. Prosternal tubercle inclined backwards, cuneiform, with broad transverse apex.

Mesonotum (scarcely exposed), metanotum and abdominal tergites with a distinct smooth median carinula, without punctures, except a few very shallow ones on metanotum.

Elytra just reaching the apex of the first tergite; inner margin weakly convex; outer margin distinctly convex; maximum width beyond the middle; all veins thick; radial veins slightly behind the middle.

Last tergite, supra-anal plate, cercus and sub-genital plate as in *A. punctata.*

General colouration blackish-brown, with light testaceous stripes along the sides of occiput and lateral pronotal carinae; inner edge of elytra with a narrow yellowish line on almost black back-ground. Abdomen almost black

above, yellowish underneath. Hind femur with the externo-median area blackened in more than the upper half, the rest being light brown; interno-

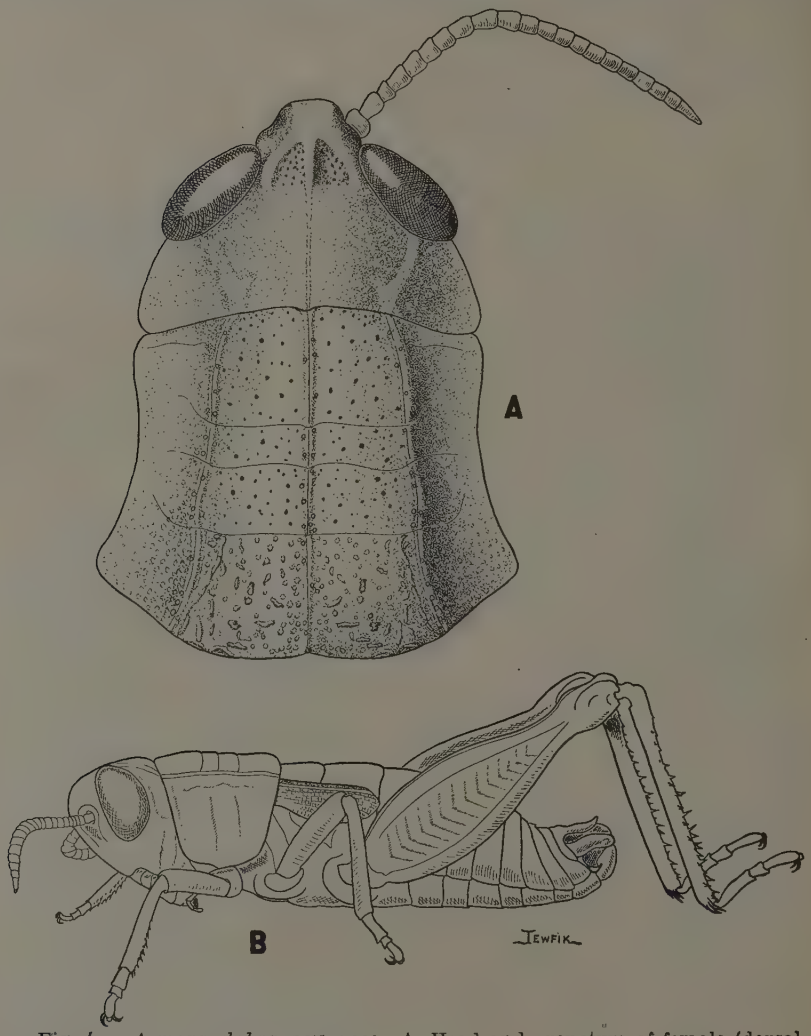


Fig. 4. — *Asmara glabra* nov. spec.: A. Head and pronotum of female (dorsal view); B. Adult male (lateral view).

median area mostly black, with an indefinite pale fascia beyond the middle, while the base and the lower edge are bright red; lower inner sulcus bright

red, except near the apex where it is yellowish; knee with dark brown semi-lunar spots on both sides. Hind tibia dirty purplish, with a paler ring near the base; spines whitish with black tips.

Female : Antennae less stout, scarcely incrassate in the middle. Disc of pronotum, especially metazona more distinctly punctured. Metanotum with faintly perceptible punctures. General colouration mostly dark brown, without pale lateral stripes (present in other paratypes). Externo-median area of the hind femur with three wide, incomplete blackish fasciae; interno-median area mostly black, with a post-median pale fascia, otherwise as in the male. Hind tibia dark sanguineous, with a paler post-basal ring.

Length of body ♂ 17.5, ♀ 27; pronotum ♂ 4, ♀ 6; elytra ♂ 3, ♀ 5.2; hind femur ♂ 10, ♀ 14 mm.

Yemen : Top of Gebel El-Nabi Shoeib, 16.VI.36; 1 ♂ (Type) and 3 ♀♀.

This species appear to represent the mountain form of *A. punctata*, differing from it in the more stout general habitus, in the decidedly shorter and thicker hind femora and generally darker colouration. Apart from these characters which may be due to differences in the altitude, there are however others, enumerated at the beginning of the description and which are probably of specific value.

It is impossible to compare the new species with the Erytrean *A. calopteroides* I. Bolivar 1914, since its type is no longer available to me, but the latter is a considerably larger insect, with differently shaped elytra.

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